THE BRITISH JOURNAL

OF

OPHTHALMOLOGY

APRIL, 1945

COMMUNICATIONS

ELECTRICAL CATARACT*

Notes on a Case and a Review of the Literature

BY

A. LOGAN ADAM *and* M. KLEIN,

LONDON

Case Report

ON August 18, 1941, H. Ch., a man, aged 51 years, had an accident at an electric power station when he came into contact with live apparatus. He was wearing metal rimmed glasses and earpieces. Second and third degree burns were present around the orbits, along the temples and the bridge of the nose. Other burns of second degree were present on the shoulder, neck and face. There were also third degree burns over the right shoulder, over the thyroid cartilage and the left hand. A discharge at 11,000 volts passed by sparking contact with the rim of the spectacles. He was admitted to St. Leonard's Hospital, and was discharged after 26 days.

Visual symptoms developed six months after the accident, when sight began to deteriorate. He sought advice at the Central London Ophthalmic Hospital on July 16, 1943, nearly two years after the accident.

On examination.—R.V. 6/18 c. +1·25 D.sph.=6/12; L.V. 6/18 c. +1·0 D.sph. +0·5 D.cyl. 110°=6/12 c. readers J.4. Right and

From the Central London Ophthalmic Hospital.

*Received for publication, October 25, 1944.

left cornea, iris and pupil: no pathological changes present. Both lenses show changes as seen in the colour plate. The opacities are mostly vacuoles in the anterior capsule, and subcapsular greyish dots, in some places confluent. On the left anterior capsule there was a scale-like grey opacity. Vitreous and fundi were normal.

General examination.—Mild hyperpiesia (B.P. 180/100). Electrocardiographic examination showed no evidence that the electric shock had affected his heart (Dr. Jenner Hoskin).

The patient was kept under observation at the C.L.O.H. for 16 months during which time the eye condition remained stationary.

Review

The occurrence of cataract due to electric shock is well established.

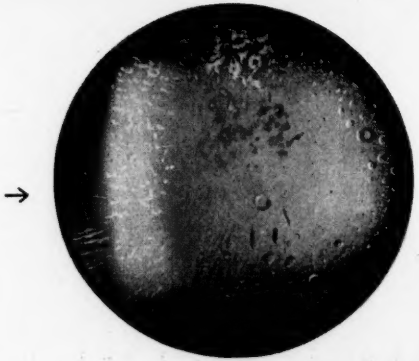
(*a*) *Morphology.*—A survey of reports of 50 cases of electrical cataract reveals that in the majority of cases the first changes are on the anterior capsule and in the anterior cortex, generally in the nature of punctate opacities with vacuoles in the anterior capsule. In a few cases the lens opacities were predominantly in the posterior cortex (Djacos, Licskó, Koeppe), and on the posterior capsule (Djacos), or at the equator (Desbriére and Bargy).

(*b*) *Histology.*—The only available report is that of Komoto (1910). He found that the capsule showed patches where there was no, or only faint, staining of the cell nuclei. Small vacuoles were present in the cortex, some of them empty, others filled with a pale eosin staining mass. The lens nucleus was normal.

(*c*) *Development of the cataract.*—In a number of cases the lens changes were observed within a few days after the accident (Godtfredsen, 1942, Becker, 1920), in others a delayed onset was reported (Holloway, 1930, Davies, 1916). It must, however, be pointed out that only exceptionally was the eye examined by an ophthalmologist immediately or soon after the accident (Ellett, 1906, Horton, 1926, Godtfredsen, 1942).

The lens changes may be unilateral or bilateral, they may be stationary, and in such cases vision may be much better than one would expect judging by the lens changes. Sometimes the apparently stationary lens changes may become progressive some months, or even as long as three years, after the accident (Le Roux, 1909, Holloway, 1930). In other cases the cataract became complete in a few weeks. In rare instances the lens opacities which were present after the accident have disappeared completely (Godtfredsen, 1942).

(*d*) *Prognosis and complications.*—The prognosis of the operation is complicated by the fact that electric shock may cause choroiditis or cyclitis, and changes of the fundus and optic nerve (Spir, 1922). A relatively rare observation is the dislocation of the lens after the accident (Freysz, 1909, case No. 1).



R.E

L.E.

R.E.

Hamblin

Experimental.—Early experiments were performed by discharge of static electricity and in this way the cataract due to lightning was imitated (Hess). In these experiments there was inevitably a flash which introduced the complicating elements of heat and ultra-violet light. Later it was shown that cataract can be produced by alternating as well as by direct current—and without a flash. (Hess and Kiribuchi, 1900; Comberg, 1936).

The lens changes may appear within a few hours after the experiment. In many experiments the electrical discharges were followed by violent reaction of the iris and ciliary body, and Hess suggested that the cataract was due to changes in the capsule epithelium, and also to changes in the ciliary body.

An experiment was reported by Comberg (1936), where the electrodes were placed respectively at the centre of the cornea and at the back of the rabbit's eye, thus ensuring that the flow of the current was mainly through the lens, and that only a fraction of the current was flowing through the iris and ciliary body. According to Comberg's calculations the current density of the discharge through the lens was three times that of the discharge through the iris, and eight times that through the ciliary body, whereas with the older experiments the current density in all these tissues was the same. In spite of these precautions, however, there was a fibrinous exudate in the anterior chamber in 67 per cent. of the experiments. Lens opacities developed in 15 out of 16 experiments without any noticeable difference between eyes with severe uveitis and those in which the irritation was slight. Observation for 12 months has shown that in seven cases the lens opacities were progressive, in six they were stationary, and in two the opacities disappeared.

Experiments with isolated lenses by Kuwabara (1909), and on isolated eyes by Bellows and Chinn (1941), have shown that electric shocks produce injury to the lens which can be demonstrated by measuring the loss of protein when immersed in saline solution (Kuwabara) and by the decrease of swelling when placed in distilled water (Bellows and Chinn).

Histology of experimental electrical cataracts.—Large areas of degeneration of the anterior capsule and at the equator were seen followed later by degenerative changes of the lens fibres, especially near the capsule. Regenerative changes were also observed (Hess, 1888; Hess and Kiribuchi, 1900).

Significance of electrical cataract as an industrial accident.—The number of publications of electrical cataract shows a steady increase which reflects the more widespread use of electricity in industry. The significance of electrical cataract as an industrial accident is best viewed in relation to other industrial eye injuries, and in relation to the total number of electrical accidents of all kinds.

1. The number of reported electrical accidents :—*

1934	1935	1936	1937	1938	1939	1940	1941	1942
81	87	112	106	127	120	150	170	181

shows a steady increase in the eight years between 1934-42.

2. The following figures taken from the Quarterly Returns of the Registrar General, Scotland, are in line with the increase in the number of deaths due to electric shock (lightning excepted) :—

1934	1935	1936	1937	1938	1939	1940	1941	1942
5	8	10	9	8	15	15	14	17

3. The number of industrial accidents in relation to electrical accidents :—†

Year	Total of all accidents in factories (fatal and non-fatal)	Number of eye injuries other than F.B.	Total of electrical accidents	Number of eye injuries due to electr.
1938	180,000	3,751	560 (30 fatal)	Data not available
1942	315,000	6,501	1,042(51 fatal)	

These figures reveal that electrical accidents in relation to the number of other industrial accidents are not frequent, and that eye injuries due to electricity are not common.

It should, however, be emphasized that though relatively rare, in every case of electrical accident the patient should be examined by an eye specialist, and kept under observation for at least one year after the accident, as electrical cataracts are of delayed onset and are usually compensation cases.

Discussion

Electrical cataract has puzzled ophthalmologists for the past 60 years. This problem, however, is extremely complicated because

* Electrical Accidents and Their Causes, 1938, London, His Majesty's Stationery Office.

† Annual Report of the Chief Inspector of Factories for the Year 1942, London, His Majesty's Stationery Office.

the only information available regarding the damage to tissues caused by electricity is that it is a specific damage to the cells, which cannot be explained by the heat, or by the chemical changes due to the passage of the current, alone. Another difficulty is that the problem of cataract formation is not yet solved, although researches during the past decades have yielded much valuable material.

Experiments carried out in such circumstances could not be expected to solve the principal problem, nevertheless they gave valuable results in showing that electric shock can produce cataract. But the process by which electrical cataract is produced is not clear. As regards the lens fibres there is experimental evidence of damage caused by the current. As regards the capsule Bellows and Chinn found that its permeability for ascorbic acid and for glutathione is not different from that of the controls. This, however, does not exclude the possibility that the capsule is damaged. Jellinek thinks that the changes of the tissues after an electric shock are comparable to changes in the pattern of metallic particles in an electromagnetic field.

There are certain points of interest. The pressure in the reported cases varied from 200 to over 40,000 volts. The points of contact shown by the location of burns was in most cases near the eye, usually on the head or neck, and the eye nearer to the contact point generally shows the more marked changes. A case was reported by Koeppe (1921), where only the contralateral eye developed electrical cataract after electrical shock and the eye nearer the burn remained healthy. In one case cataract developed where head and neck burns were absent, and the points of contact were at the two hands Gabrièlides, 1935).

The duration of contact, the dryness or moisture of the skin, and the path taken by the current possibly have an influence on the development and type of the cataract.

In almost every case reviewed, severe burns were present arising from an electrical discharge to the body by sparking. The clinical material shows a certain similarity to that group of experiments in which the electrical shock was accompanied by a flash. Exceptionally, however, cases are reported where cataract developed from flash only (Freysz, 1909, Case No. 2 and 3, Hackel, 1932) and the patient did not feel an electric shock. In these cases the cataract is strictly speaking not electrical in origin, but as an industrial accident it comes under this heading.

In the case described in this paper there was sparking flash, and the passage of electricity through the body.*

*As a practical suggestion it is advisable that persons employed in electric power stations should not wear spectacle rims containing metal (A. H. Levy).

Summary

A case of electrical cataract is described.

A review of the literature shows that the number of electrical cataract cases has increased recently, and this corresponds to the increase in the number of electrical accidents of all kinds.

In electrical cataracts the onset of the patient's symptom is usually delayed, and only a few cases have been thoroughly investigated immediately after the accident. The burns of the face and other parts of the body are usually so severe that a thorough eye examination is very difficult; the patients are usually admitted to general wards in a severe condition, and only after general recovery is attention directed to the eyes.

The evidence hitherto collected is not sufficient to enable us to state the cause of electrical cataract or the process by which it develops. Much useful information could be obtained if all cases of electrical accidents were examined immediately or as soon as practicable after the shock, possibly with a slit-lamp, and were kept under observation for about a year.

Acknowledgement.—Our thanks are due to Mr. H. P. Gibb for permission to publish this case.

REFERENCES

EXPERIMENTAL

1. HESS, C. (1888).—*VII International Ophthal. Congress, Heidelberg.*
2. KIRIBUCHI (1900).—*Arch. f. Ophthal.*, Vol. L.
3. HESS and KIRIBUCHI (1900).—*VIII Cong. Internationale d'Ophtal.*, p. 308.
4. KUWABARA, T. (1909).—*Arch. f. Augenheilk.*, Vol. LXIII, p. 1.
5. FRESE, H. (1922).—*Arch. f. Augenheilk.*, Vol. XCI, p. 278.
6. COMBERG, W. (1936).—*Ber. d. Deutsch. Ophthal. Ges.*, Vol. LI, p. 132.
7. BELLOWS, J. G. and CHINN, H. (1941).—*Arch. Ophthal.*, Vol. XXVI, p. 606.

CLINICAL

1. DESBRIERES and BARGY, M. (1905).—*Ann. d'Ocul.*, Vol. CXXXIII, p. 118.
2. BISTIS, J. (1906).—*Zeitschr. f. Augenheilk.*, Vol. XVI, p. 526.
3. ELLETT, E. C. (1906).—*Ophthalmic Record*, Vol. XV, p. 4.
4. LUNDSGAARD, K. K. (1907).—*Wien. Med. Wochenschr.*, February.
5. TERRIEN, F. (1908).—*Arch. d'Ophtal.*, Vol. XXVIII, p. 679.
6. LE ROUX, H. (1909).—*Arch. d'Ophtal.*, Vol. XXIX, p. 523.
7. ROCHE, C. (1909).—*Ann. d'Ocul.*, Vol. CXLI., p. 347.
8. DOR, L. (1909).—*La Clin. Ophtal.*, p. 141.
9. FREYSZ, H. (1909).—*Beitr. zur. Augenheilk.*, Vol. 8, p. 179.
10. KOMOTO, J. (1910).—*Klin. Monatsbl. f. Augenheilk.*, Vol. XLVIII, p. 126.
11. ROBINSON, J. M. (1910).—*Ophthalmic Record*, Vol. XIX, p. 165.
12. BICHELONNE, M. (1910).—*Ann. d'Ocul.*, Vol. CXLIV, p. 108
13. BRANDEIS, P. (1911).—*Bull. de la Soc. Belge Ophthal.*, November.
14. GRIMSDALE, H. B. and JAMES, R. R. (1911).—*The Ophthalmoscope*, Vol. IX, p. 315.
15. DALÉN, A. (1911).—*The Ophthalmoscope*, Vol. VIII, p. 659.
16. MORAX, V. (1911).—*Ann. d'Ocul.*, Vol. CLV, p. 357.
17. JOCKS, R. (1912).—*La Clin. Ophtal.*, Vol. XVIII, p. 170.
18. HASHIMOTO (1913).—*Ophthalmology*, p. 187, October.
19. MILLS (1913).—*Arch. Ophthal.*, Vol. XLII, p. 395.

20. LAUDER, E. (1914).—*Ophthalmology*, Vol. X, p. 251.
21. BIELSCHOWSKY (1916).—*Münch. Med. Wochenschr.*, Vol. LXIII, p. 501.
22. DARIC (1916).—*The Ophthalmoscope*, p. 639.
23. DAVIES, D. LEIGHTON (1916).—*The Ophthalmoscope*, Vol. XIV, p. 649.
24. BECKER (1920).—*Ber. d. Deut. Ophthal. Ges.*, p. 294.
25. KOEPPE, L. (1921).—*Klin. Monatsbl. f. Augenheilk.*, Vol. LXVI, p. 387.
26. SPIR, E. (1922).—*Arch. f. Augenheilk.*, Vol. XC, p. 127.
27. GJESSING, H. G. A. (1922).—*Brit. Jl. Ophthal.*, Vol. VI, p. 447.
28. FRESE, H. (1922).—*Arch. f. Augenheilk.*, Vol. XCI, p. 278.
29. LICSKÓ, A. (1923).—Ref. *Zentralbl. f. Ges. Ophthal.*, Vol. IX, p. 235.
30. BRUNER, W. E. (1924).—*Amer. Jl. Ophthal.*, Vol. VII, p. 950.
31. HORTON, J. J. (1926).—*Amer. Jl. Ophthal.*, Vol. IX, p. 841.
32. FOUSSARET (1930).—La cataracte provoquée par l'electricité. Thése, Lyon.
33. HOLLOWAY, T. B. (1930).—*Amer. Jl. of Ophthal.*, Vol. XIII, p. 595.
34. CAVKA, V. (1930).—*Zeitschr. f. Augenheilk.*, Vol. LXXI, p. 156.
35. WÜRDEMANN, H. V. (1932).—Injuries of the eye. H. Kimpton, London.
36. RHODES, D. H. (1932).—*Amer. Jl. of Ophthal.*, Vol. XV, p. 1059.
37. HECKEL, E. B. (1932).—*Amer. Jl. Ophthal.*, Vol. XV, p. 1059.
38. WEILL, NAGELDINGER, NORDMANN (1933).—*Bull. Soc. Ophtal., Paris*, pt. I, p. 292.
39. GABRIELIDES, A (1935).—*Arch. d'Ophtal.*, Vol. LII, p. 394.
40. DJACOS, C. (1936).—*Arch. d'Ophtal.*, Vol. LIII, p. 454.
41. SKYDSGAARD, H. (1939).—*Acta Ophthal.*, Vol. XVII, p. 470.
42. GODTFREDSEN, E. (1942).—*Acta Ophthal.*

THE EFFECT OF ASCORBIC ACID ON THE OCCURRENCE OF HYPHAEMA AFTER CATARACT EXTRACTION*

BY

IDA MANN *and* A. PIRIE

NUFFIELD LABORATORY OF OPHTHALMOLOGY, THE EYE HOSPITAL, OXFORD

CONTROVERSY over the causes and possible prevention of post-operative hyphaema after cataract extraction has continued from 1867 (the publication of the first series of 100 extractions performed by Von Graefe's method) until the present day. In 1942, de Voe, in a very complete clinical and experimental paper on the question, gave, as his list of possible causes to be investigated, the age of the patient, the season of the operation, the social status of the patient, the blood pressure, the presence of diabetes or syphilis, the intra-ocular pressure, the type of operation performed, including use or otherwise of sutures and of iridectomy, the skill of the surgeon, the use of retro-ocular injection, post-operative trauma, plasma vitamin C level, capillary fragility and prothrombin level of the blood. In a study of 453 cases of operation for cataract he found that variations in these factors were not related to the incidence of post-operative haemorrhage which throughout the series occurred in approximately 20 per cent. of the cases.

* Received for publication January 26, 1945.

The basis of the opinion that ascorbic acid deficiency may increase post-operative haemorrhage lies in the work, summarised by Bourne (1942), which has shown that ascorbic acid is necessary for the healing of wounds; its absence prevents the synthesis of the intercellular supporting materials which form the framework for healing (Höjer (1924)). This has led ophthalmologists to try the prophylactic administration of ascorbic acid in cataract extraction on the warrantable assumption that the blood, which appears on the second to the tenth day after operation, comes from either the small newly formed blood vessels at the section or from the cut edges of the iris.

In studying the possible relation between plasma ascorbic acid level and hyphaema de Voe investigated 136 patients. He found that if the plasma level were over 0·5 mg. ascorbic acid per 100 ml. the occurrence of hyphaema was not influenced by the plasma ascorbic acid level. But of the five patients who had a plasma ascorbic level below this value four had hyphaema. De Voe concludes that deficiency of ascorbic acid is not the common cause of hyphaema, but that if the intake of ascorbic acid is suspected of being low it is good practice to give ascorbic acid to the patient before operation.

Other workers have reported that dosage of an unselected group of patients with ascorbic acid reduced the incidence of hyphaema. Urbanek and Albrecht (1938) who saturated their patients with ascorbic acid by giving large doses on the day and subsequent to the day of operation, state that the tendency to post-operative bleeding is greatly reduced by such treatment. A similar result was claimed by Malling (1938).

Surveys of English wartime food have shown that, particularly in winter and early spring, it is deficient in ascorbic acid. It is therefore unlikely that the average plasma ascorbic acid level is as high here and now as it was in the series of patients studied by de Voe in America. Richter and Croft (1943) found that the blood ascorbic acid of 350 normal factory workers from Birmingham varied from 0·15–0·85 mg. per 100 ml. with an average of 0·25 mg. These estimations were done in May, June and July, a time at which people are beginning to get early summer fruits and vegetables. Prunty and Vass (1944) found even lower levels of plasma ascorbic acid in a small series of hospital in-patients and Macbeth (1943) reported that the average plasma ascorbic acid for all hospital patients examined at the Radcliffe Infirmary, Oxford, in 1942 was 0·22 mg. per 100 ml. in January-April, 0·37 mg. in May-August and 0·2 mg. in September-December of that year.

If we are justified in assuming that ascorbic acid deficiency is a factor in the production of hyphaema it follows that we should be able to demonstrate this more clearly now than ever before, as

the low ascorbic acid intake should lead to an increased incidence of hyphaema which should be reduced by saturation of the patient with ascorbic acid before operation. An experiment was therefore designed to settle this point.

Briefly, the results of all the cataract operations in our hospital for the year 1942-43, when ascorbic acid was not given, were compared with a similar series for 1943-44, with the difference that an attempt was made to saturate every patient in the latter series with ascorbic acid at the time of operation. All other factors such as surgeons, type of operation, diet in hospital, etc., remained the same throughout the two years.

The records of all cataract operations done at the Oxford Eye Hospital between August 1, 1942 and July 31, 1943, were collected and analysed and this group of 78 cases formed the base line for assessing the effect of ascorbic acid. From October 1, 1943, to June 30, 1944, all patients coming in for cataract extraction were given ascorbic acid tablets one month before they came in and told to take two 50 mg. tablets each day. If their admission was delayed a further supply was sent. In order to check whether the patients did in fact take the ascorbic acid a urine saturation test was done while in hospital awaiting operation. On the day following admission (patients are usually admitted two days before operation) 500 mg. ascorbic acid was given by mouth at 10 a.m. and a urine sample collected between 2-5 p.m. into a bottle containing 20 c.c. glacial acetic acid. The ascorbic acid content of this sample was determined using the usual 2·6 dichlorphenol indo-phenol titration method. Different authors take different criteria in assessing saturation. Harris (1940) takes a 50 mg. excretion of ascorbic acid/10 stone body weight in a 2½ hours test period on the second day of dosing with 70 mg./stone body weight as evidence of saturation. On the other hand, Smith (1938) and Urbanek and Albrecht (1938) take 50 per cent. and Prunty and Vass (1943) a 33 per cent. excretion of the test dose in 24 hours as saturation. We have used three hour urine samples taken four hours after the test dose when the rate of excretion is at its highest, so that we are not justified in multiplying the excretion during this period by eight to get the total 24 hour excretion. Instead we have taken a 5 per cent. excretion of the test dose, *i.e.*, 25 mg. in the three hours test period as a satisfactory level of excretion. In addition to this test dose the day after admission, all the patients were given 100 mg. ascorbic acid a day while in hospital.

Results

The number of cataracts operated on in 1943-44 was much less than in the previous year owing to the fact that only battle casualties could be admitted after June 6. In 1942-43 there were 78

extractions, but in 1943-44 there were only 39 as admission of waiting list cases was only possible during the nine months under survey. The results are set out in Table I, which shows that the treatment with ascorbic acid has had no effect on the incidence of hyphaema.

TABLE I.—*Incidence of hyphaema in 1942-43 and 1943-44*

Year	Total number of extractions	Number of hyphaema	Percentage hyphaema
1942-43	78	20	25·6
1943-44	39	12	30·7

Table II gives the results of the test of saturation with ascorbic acid, which tells us whether the patient did in fact take the tablets given to him during the month before operation. The average excretion of ascorbic acid during the test period of three hours by the uneventful cases was 10·3 per cent. of the test dose and the excretion by the hyphaema cases was 7·0 per cent. Four of the ten hyphaema cases had an excretion below 5 per cent. of the test dose, whereas only two of the 25 uneventful cases had such low excretions. Two hyphaema cases were excluded from the estimation of saturation owing to changes in the time of urine collection.

TABLE II.—*Ascorbic acid excretion during 3 hour test period after a dose of 500 mg. ascorbic acid given 4 hours previously.*

Percentage excretion of test dose

In uneventful cases				In hyphaema cases	
No.		No.		No.	
1	8·1	14	9·8	1	4·5
2	11·1	15	6·4	2	9·0
3	15·6	16	9·0	3	6·2
4	11·2	17	9·6	4	4·0
5	6·9	18	9·6	5	0·0
6	4·8	19	20·0	6	13·8
7	5·3	20	15·2	7	10·0
8	12·0	21	5·7	8	10·0
9	5·7	22	10·9	9	10·6
10	0·0	23	10·0	10	2·4
11	13·9	24	14·0		
12	8·0	25	17·8		
13	17·4				
		Average	10·3	Average	7·0

Number of cases with excretion less than 5 per cent. of test dose during three hour period.

Uneventful cases $\frac{2}{25}$ Hyphaema cases $\frac{4}{10}$

At first sight this might seem to show, as de Voe thought, that, below a certain level, the less vitamin C available the greater is the tendency to bleed. But the figures for 1942-43 contradict this idea. In this year no ascorbic acid was given, so that the level of ascorbic acid saturation will have been even lower than that of the patients in 1943-44, who, even if they did not take the ascorbic acid at home, did get 500 mg. on test and then 100 mg. per day while in hospital. Yet the percentage of cases with hyphaema was less in 1942-43 than it was after ascorbic acid treatment. Our results, therefore, conflict with those of Urbanek and Albrecht and Malling and agree with those of de Voe in that we find that even in wartime England, where the population is generally low in ascorbic acid, saturation of the patient with ascorbic acid does not decrease the incidence of hyphaema after cataract extraction, all other conditions remaining the same.

Summary

There is no evidence that the occurrence of hyphaema following cataract extraction is influenced by administration of ascorbic acid.

We wish to thank Miss M. Barnett for technical assistance and Dr. A. Hirtenstein for the collection of the data for 1942-43 from the hospital records. It is a pleasure to record the assistance given by the surgeons and nursing staff of the Oxford Eye Hospital and the generous gift of ascorbic acid by Roche Products Ltd.

REFERENCES

BOURNE, G.—*Lancet*, Vol. II, p. 661, 1942.
HARRIS, L. J.—*Lancet*, Vol. II, p. 299, 1940.
HOJER, J. A.—*Acta Paediat.*, Vol. III, p. 8, 1924.
MACBETH, R. G.—*Jl. Laryn. and Otol.*, October, 1943.
MALLING, B.—*Med. Rev.*, Vol. LV, p. 280, 1938.
PRUNTY, F. T. G. and VASS, C. C. N.—*Lancet*, Vol. I, p. 180, 1944.
PRUNTY, F. T. G. and VASS, C. C. N.—*Biochem. Jl.*, Vol. XXXVII, p. 623, 1943.
RICHTER, D. and CROFT, P. G.—*Biochem. Jl.*, Vol. XXXVII, p. 707, 1943.
SMITH, S. L.—*Jl. Amer. Med. Assoc.*, Vol. CXI, p. 1753, 1938.
URBANEK, J. and ALBRECHT, W.—*Zeitschr. f. Augenheilk.*, Vol. XCV, p. 129 1938.
DE VOE, G.—*Arch. Ophthal.*, Vol. XXVIII, p. 1069, 1942.

ABERRANT OPTIC NERVE FIBRES FOUND BETWEEN RETINA AND HEXAGONAL CELLS*

BY

Professor ARNOLD LOEWENSTEIN (Prague)†

NERVE fibre bundles of different size aberrant from the optic nerve escape according to Ida Mann (1937) from the confines of the optic stalk, and become free in the orbit. They originate at an early stage (about 17 mm. length) when the nerve fibres find their way from the ganglion cells into the optic stalk. Anatomically they are a division of the main stem of the optic nerve in its orbital or intracranial course. In the case of Sneed (1914) which I have observed with this author the right optic nerve was split in front of the chiasma into a smaller temporal and a thicker nasal thread. Each had its own sheath. In the case of Scheerer (1923) the optic nerve was considerably broadened behind the cribriform plate. Histologically this author could prove that the nerve fibres had left the optic nerve through gaps in the pia in the shape of bundles of the optic nerve are described by E. Fuchs, Ganser, and others. Von Szily (1924) has modelled such aberrant fibres in his reconstruction of the eyes of rabbit embryos of a coloboma strain. The aberrant bundles appear at the outside of the eye, but are to be found among the cells of the pigmented epithelium as well.

Nothing is known so far about aberrant nerve fibres of the optic nerve closely behind the retina. As I have observed two cases of entirely different aetiology and there are interesting biological questions linked with this phenomenon, the anatomical findings should be mentioned.

First Case

L., Max, aged 46 years, had always normal vision. Was a soldier and had to shoot aiming with his right eye. Lues admitted 20 years ago, treated locally only. His vision of the right eye was failing two years ago, treatment: 10 injections of Hg and Bi; some intravenous injections of salvarsan. Hair dark brown, irides chestnut, without warts. Anterior halves of both eyes normal. Media clear. Right pupil 4, left 2½ mm., both slightly irregular, positive Argyll Robertson. Right fundus (Fig. 1): The nasal 2/3 of the disc is occupied by a dark, nearly black growth prominent over the unpigmented area—nasally the black tissue transgresses the margin of the disc slightly. The prominence of the

* Received for publication, April 28, 1944.

† From the Tennent Institute of Ophthalmology, University of Glasgow (Professor W. J. B. Riddell).

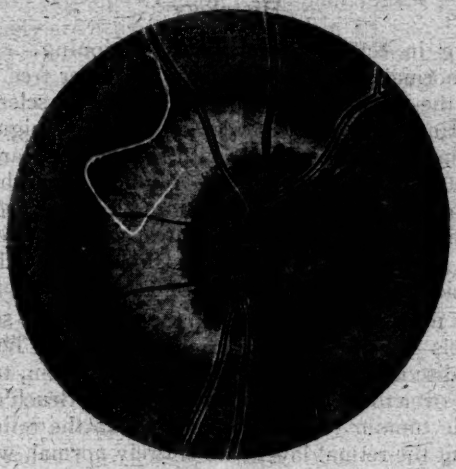


FIG. 1.

Melanotic tumour of the disc. The tumour infiltrates slightly the retina. The tissue of the unimpaired disc is out of focus.

most superficial greyish fluffy tissue is about 3 D. compared with the temporal disc tissue (which appears out of focus with the Stereo-Gullstrand-ophthalmoscope). The vessels—arteries and veins—have a thin whitish sheath. Fundus towards the periphery tesselated.

Left eye is normal except for a typical Argyll Robertson pupil.

Vision: R. eye, fingers at 3 m. L. eye, 6/5 no + glass.

Field of vision: R. eye: much contracted from all sides except *temporal* (with 5 cm. mark), but even 10 cm. mark colours not recognized. L. eye: normal.

Urine: nothing abnormal. Reaction for melanin (1) Thormaelen (2) Brahn negative.

Wa. R: ++++

Meinicke { *a* +++ / *b* + }

Mueller +++

Schiötz { R. 27 mm. Hg. / L. 19 mm. }

After three weeks energetic antiluetic treatment no improvement.

Excision of the eye January 18, 1939. No further observation possible due to external conditions.

Histology

Embedding in celloidin—horizontal sectioning. Conjunctiva and cornea normal. Angle of anterior chamber free. The tissue in front of the widely open Schlemm's canal, scleral spur and Schwalbe's ring is densely powdered with snuff pigment. Some vessels linking Schlemm's canal with scleral veins are pigmented too. Iris is amply pigmented, the pigmented epithelium cystic (there is no diabetes). Dilatator fibres are framed with slim stroma pigment cells. Sphincter fibres are powdered with pigment dust. Pigmented epithelium is thickened in the periphery of the choroid, especially in places of Blessig-Iwanoff's cysts.

The black mass fills about 3/4 of the optic cross section. The central vessels are enveloped by the black mass. The nasal part of the optic disc is bulged forward like a mushroom, tumour tissue pushes itself over the hyaline thickened end of Bruch's membrane. As far as the tumour reaches into the retina the retinal structure is upset. But the retinal layers are entirely normal, where there is no tumour tissue. The melanotic masses infiltrate the choroid somewhat deeper (about 1000μ) (Fig. 2).

The tumour leaves temporally a strip of optic nerve tissue uncovered, the breadth of which varies between 130-450μ. The black masses perforate the cribriform plate (Fig. 3). There the diameter of the cross section of the optic nerve is doubled.

At the temporal margin of the disc the retina is detached from the pigmented epithelium by a broad layer of unpigmented nucleated fibres which originate in the optic nerve as each section demonstrates (Fig. 4). They run in arcs from the retinal nerve fibre layer on one side and from the optic nerve on the other. They turn sharply at both ends of the base of the triangle inwards into the triangle and converge slightly to the acute angle at the edge. They are at the broadest spot of the triangle, the end of the pigmented epithelium, about 20 layers thick. The whole triangle is 700μ long. But this well stained nerve fibre tissue is continued another 650μ farther subretinally by a less well stained, less differentiated tissue. The retina over the subretinal growth consists of the anterior layers only. No outer granular nor outer nuclear layer is present within 600μ from the disc. From there on for 750μ the outer nuclear layer is represented by *one* row of nuclei only, which are remarkably big. This cell type may perhaps correspond to the cone nuclei. The maldevelopment of the outer retinal layer is limited exactly to the extent of the subretinal growth. A very delicate line may be the remnant of the outer limiting membrane. Retinal structure close to the malformation is completely normal including the neuro-epithelium. Pigmented epithelium—as far as

a cross section can tell—is normal. Ciliary nerves perforating the sclera obliquely are heavily pigmented (Fig. 5).

At the *depigmented* slide the tumour cells are polyhedric (Fig. 6) with oval nucleus, a slightly granular plasma and visible cellular boundaries. There are fine dark fibres which can be seen distributed over the whole tumour area (Fig. 7). These fibres are much thinner than the nerve fibres outside the tumour. In some areas of the tumour the nuclei are shrunken and pressed to the cellular walls, in others the cells are swollen, the nuclei missing.

Discussion

In spite of the fact that I did not save from Prague more than 11 slides of this case and no specific nerve staining was performed, I now suppose that the subretinal tissue consists of nerve fibres. These fibres can be followed up perfectly into the optic nerve, where they turn sharply.

Aberrant nerve fibre bundles of the optic nerve have not been described so far within the tissue of the human eyeball. It is of great interest that the retina is maldeveloped in its posterior layers corresponding to the whole extent of the subretinal growth.

We know that the inner retinal layers are built up prior to the outer layers (I. Mann, 1928). When the percipient layers (rods and cones) appear the inner layers are complete and the ganglion cells have already sent out their fibres into the cavity of the optic stalk. If some fibres aberrate and grow under the retina they may interfere with the development of the outer retinal cells.

The question is justified whether this black mass is a malignant growth at all. The depigmented cells are of a shape which we are used to link with naevus. On the other hand, the deterioration of the vision is undoubtedly of fresh date and no other reason for the failing sight was discovered by repeated examination. The optic disc of the diseased eye was as pink as the other—therefore a tabetic atrophy could be excluded in which the pallor of the disc is mostly obvious at a time when no failure of function is yet recognizable. Retina and choroid were infiltrated by the tumour. Therefore the conclusion seems justified that a growing tumour is responsible for the failing vision. Malignant degeneration of pigmented naevi is well known in skin, iris and choroid.

The presence of pigmented naevi in the optic nerve is well understandable. The optic stalk consists of the two layers of the secondary cup into which the nerve fibres of the retinal ganglion cells grow. The outer layer of the optic stalk is therefore the cell form corresponding to the hexagonal cells. It becomes converted into unpigmented (in man) neuroglial supporting tissue (I. Mann,

1928). We understand that cells of the outer layer of the stalk having escaped conversion into neuroglial tissue may have preserved their primitive nature and the capacity of pigment production like the other cells of the outer layer of the cup. These isolated explanted cells appear as pigmented naevus and are prone to malignant growth.

We have found a second case of nerve fibres behind the retina which we have to explain in an entirely different fashion. It was discovered before the abnormality in the first case was understood and has directed actually my attention to the problem. It was the posterior half of an eye received post-mortem, a hypertensive retinopathy which we have studied with A. J. Ballantyne in the course of other investigations.

There was a high grade retinal oedema with fatty exudate mostly in the outer granular layer, multiple groups of cytoid bodies in the retinal nerve fibre layer, endothelial and subendothelial fatty necrosis of arteries and veins of retina and choroid and a subretinal exudate. The disc was markedly oedematous and many cytoid bodies were found within its nerve fibres.

A big " druse " of 240 : 140μ size stained with haematoxylin dark purplish, bulges the fibres of the optic nerve over the end of Bruch's membrane (Figs. 8 and 9). The lime content is responsible for its being broken up. There is a triangular shaped process from the optic nerve with its base in front of the cribriform plate pushing itself between retina and the irregular pigmented epithelium. This tissue between retina and pigmented epithelium is 920μ long and at its base 270μ broad and consists of nerve fibres at its base which can be followed up into the nerve fibres of the optic nerve. The greater mass of this subretinal tissue is characterized by the presence of huge typical cytoid bodies.

There is no maldevelopment of the retina present in front of the tissue, except some damage to the rods and cones, always found with subretinal exudate. The cytoid bodies in the retinal nerve fibre layer and in the retroretinal tissue are indistinguishable. There is no reason to assume in this case a congenital anomaly as in our first case. There is no maldevelopment of the posterior retinal layers. We suppose that the swollen oedematous disc with the production of the big " druse " led to a rupture of the lining of the optic nerve at the height of Bruch's membrane. The fibres of the optic nerve grew out or were pushed out mechanically by a vis a tergo from the oedematous tissue of the optic nerve into the gap between retina and hexagonal cells. They degenerated in a ganglioform manner.

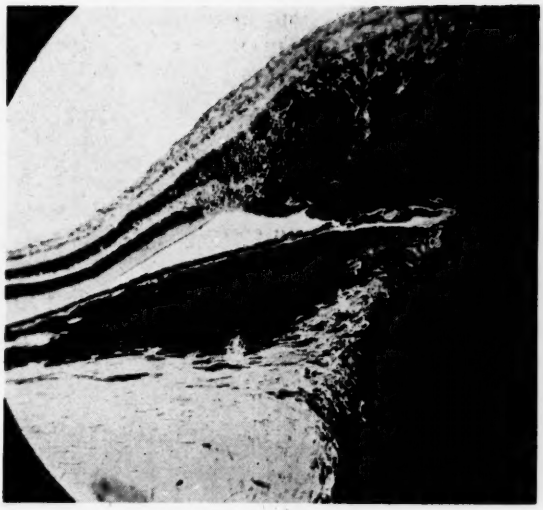


FIG. 2.

Mushroom-like growth of the pigmented tumour infiltrating retina and choroid.

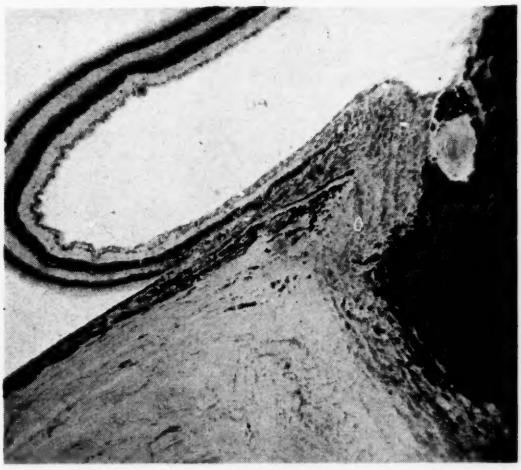


FIG. 3.

Melanoma of the disc. R.E. low power. Fig. 3 represents the other half of the disc shown in Fig. 2, the section having been mounted in obverse fashion.

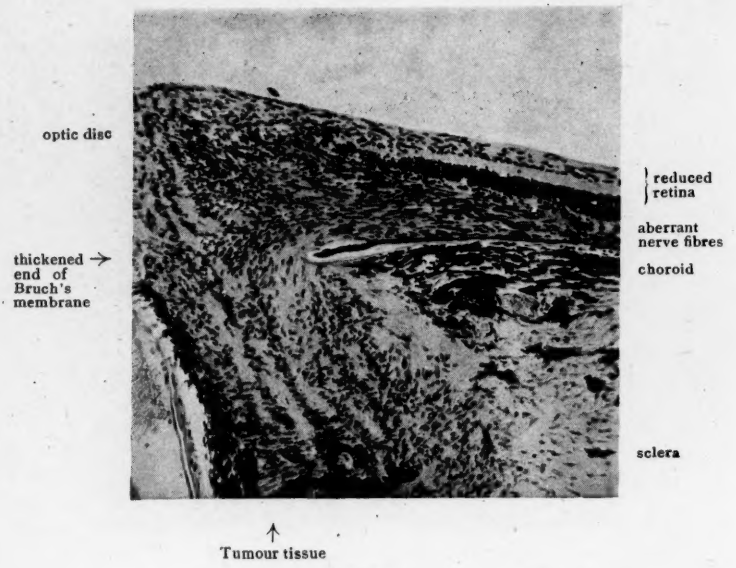


FIG. 4. High power.

Temporal part of the disc with the aberrant nerve-fibre bundles.

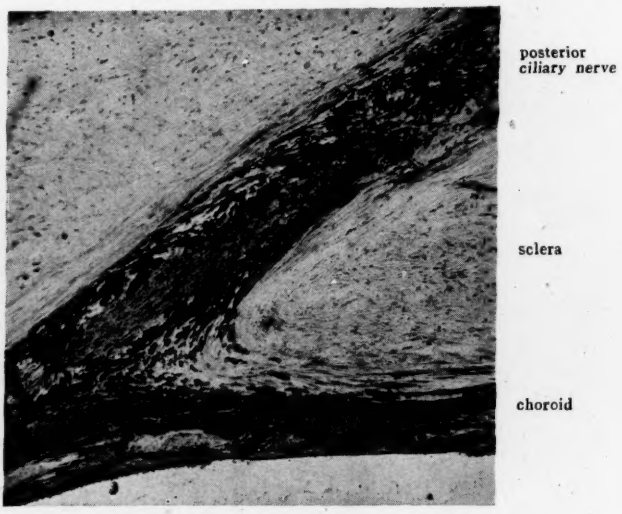


FIG. 5.

A posterior ciliary nerve covered with stroma pigment and its insertion in locally thickened choroid.

FIG. 6.

Depigmented tumour of the optic nerve towards the normal posterior part of the excised optic nerve.

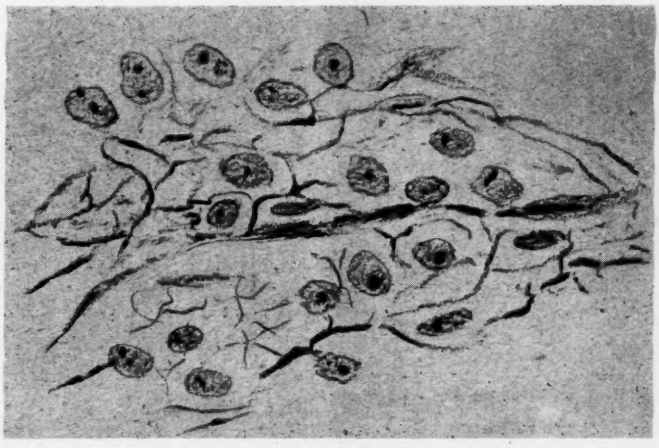


FIG. 7.

Melanotic tumour of optic nerve. Depigmented. (675×). Note the big epithelial cells with round or polyhedric nuclei and one or two nucleoli.

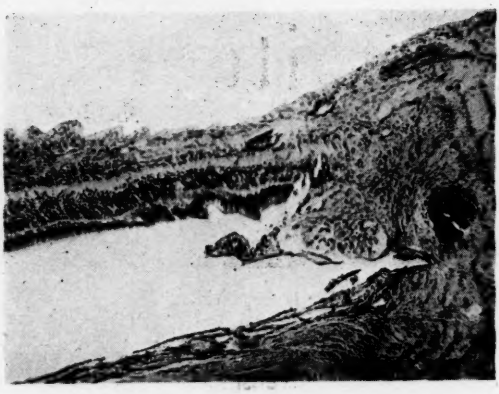


FIG. 8.

Hypertensive retinopathy. (60×). Subretinal cytoid bodies.

FIG. 9.

High power. (150×).

Summary

Two different kinds of aberrant nerve fibres of the optic nerve are described, they are found between retina and hexagonal cells. One type involves maldevelopment of the posterior retinal layers in front of the growth. This was a case of a pigmented tumour of the optic disc infiltrating into the neighbouring retina and choroid. It is assumed to be a malignant degeneration of a pigmented naevus of the optic disc. The second is a case of hypertensive retinopathy with oedematous swelling of the papilla and a big druse. The nerve fibre tissue found between retina and pigmented epithelium is ganglioform degenerated. The retina in front of this tissue is well developed. A mechanical pushing out of the optic nerve fibres due to the oedema and the pressure of the druse is assumed to be the cause.

LITERATURE

MANN, IDA.—Development of the human eye. Cambridge, 1928.
——— Developmental abnormalities of the human eye. Cambridge, 1937.
SCHEERER.—*Klin. Monatsbl. f. Augenheilk.*, Vol. LXXI, p. 674, 1923.
SNEED.—*Arch. f. Augenheilk.*, Vol. LXXVI, p. 117, 1914.
VON SZILY.—*Zeitschr. f. Anatomie*, Vol. LXXIV, p 1, 1924 (reprint).

THE EFFECT OF DETERGENT ON THE PENETRATION OF SODIUM SULPHACETAMIDE (ALBUCID SOLUBLE) INTO OCULAR TISSUES*

BY

M. GINSBURG *and* J. M. ROBSON

(FROM THE DEPARTMENT OF PHARMACOLOGY, UNIVERSITY OF EDINBURGH)

IT has been shown recently (Bellows and Gutman, 1943; Leopold and Schele, 1943) that the penetration of sulphonamides applied locally to the eye can be increased by various wetting agents.

In a number of investigations (see Robson, 1944; Robson and Scott, 1944) it has been found that experimental infections of the cornea with various organisms can be treated successfully by the local application of a number of sulphonamides, the most satisfactory results being observed with sodium sulphacetamide. This substance penetrates readily into the cornea and does not produce any irritation. The present experiments were carried out to determine whether the penetration of sodium sulphacetamide can be

* Received for publication, November 10, 1944.

increased still further by the use of a wetting agent. In addition investigations were performed to localise the site of action of the agent and if possible to obtain some information on its mode of action.

Methods

Experiments were performed on mature rabbits of various breeds and both sexes.

Ten per cent. solutions of sodium sulphacetamide in water and freshly made 0·1 per cent. solutions of duponal ME dry in water were used throughout. Duponal ME (minimum electrolyte) dry is a detergent derived from technical lauryl alcohol.

In the first series of experiments, the drug was applied by means of celluloid funnels, as described by Robson and Tebrich (1942). The solutions were applied to the anaesthetised animal for 6 minutes, 10 per cent. sodium sulphacetamide to one eye, and 10 per cent. sodium sulphacetamide + 0·1 per cent. duponal to the other eye of the same rabbit, after which the funnels were removed and the eyes excised and dissected for analysis. Similar experiments were also performed on eyes with denuded corneae, and on excised eyes. The cornea was denuded by removing all the epithelium with a fine knife, care being taken not to injure the substantia. In the experiments on excised eyes, the funnel was sewn in place in the dead animal (immediately after killing), and incisions were made through the lids so that the eye together with the lids could be excised, with the conjunctival sac intact and the funnel in position. The funnel was clamped vertically and the eye supported on a pad of cotton wool.

In the second series of experiments drops were instilled into the conjunctival sac. As the volume of the drops is smaller in the presence of the wetting agent, a definite volume of the solution was applied as follows:—0·1 ml. of one solution was instilled into the conjunctival sac of one eye, and the lids then gently closed and opened for 20 seconds. Two minutes later, 0·1 ml. of the other solution was instilled into the other eye under the same conditions. The rabbits were killed and the eyes excised and dissected for analysis 15 minutes, 1 hour and 3 hours after the application of the drug. The two solutions were alternately used first in different rabbits in order to cancel out any possible errors due to reduced circulation, caused by loss of blood in the removal of the first eye. (Subsequent experiments suggest that this is negligible.)

In all cases the eyes were washed in saline immediately after removal and dried on blotting paper. The various tissues were then dissected off, rapidly washed in saline, and dried on blotting paper.

In the third series of experiments the effect of duponal on the penetration of sodium sulphacetamide into excised parts of the eye was investigated. Throughout these experiments *in vitro*, the excised eye, or parts of the eye, were kept moist by bathing as much as possible in a solution similar to the anterior chamber fluid (see Duke-Elder, 1927) and containing the following substances in the following percentage concentrations: NaCl (0·71); KCl (0·038); $CaCl_2$ (0·017); glucose (0·1).

In these experiments, the eye was excised and cleared of muscle and conjunctiva. It was then opened at the posterior pole so that

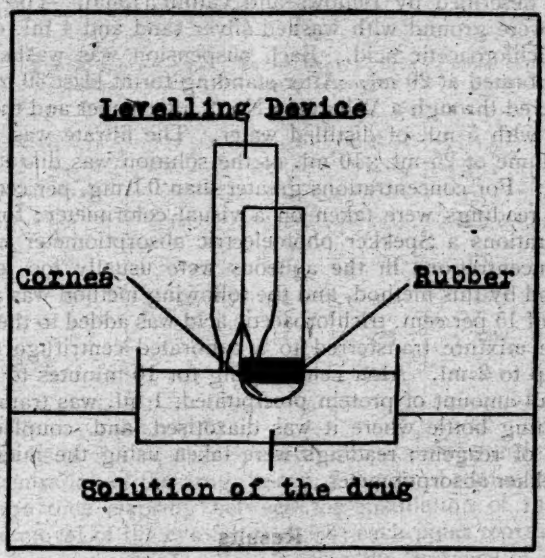


FIG. 1.

Method used for studying the permeability of tissues.

the cornea and sclera together formed a sac, from which the lens, iris, choroid, and retina were removed. The sac was drawn over the end of a small glass tube, of diameter slightly smaller than that of the cornea, so that the cornea, excluding the limbus, formed a membrane over the mouth of the tube (see Fig. 1). The membrane was secured in position by a loop of silk thread, which was covered with tightly bound layers of elastic insulating rubber. 0·8 ml. of the anterior chamber fluid was placed inside the tube which was lowered into a solution of the drug; the levels were adjusted by means of a small perspex slip, cut so that it had two equal legs and a slit so that it could move freely up and down the

side of the glass tube: the level of the solution inside the tube was the same as that outside, when both legs were just touching the solutions. After 5 and 15 minutes the contents of the tube were stirred by a stream of air from a syringe and 0·1 ml. of the fluid removed for analysis. The drug content of the tissue was also estimated after 15 minutes. This method was used for studying the penetration of sodium sulphacetamide through the cornea, the sclera, and the denuded cornea.

The chemical analysis was based on the method of Bratton and Marshall (1939), and the preparation of tissue extracts on the method described by Bellows and Chinn (1939). The weighed tissues were ground with washed silver sand and 4 ml. of 15 per cent. trichloroacetic acid. Each suspension was washed into a tube calibrated at 20 ml. After standing for at least 30 minutes it was filtered through a Whatman No. 2 filter paper and the residue washed with 5 ml. of distilled water. The filtrate was made up to a volume of 25 ml.; 10 ml. of the solution was diazotised and coupled. For concentrations greater than 0·1 mg. per cent. in the filtrate, readings were taken on a visual colorimeter; for smaller concentrations a Spekker photoelectric absorptiometer was used. The concentrations in the aqueous were usually too low to be estimated by this method, and the following method was adopted: 0·4 ml. of 15 per cent. trichloroacetic acid was added to the aqueous and the mixture transferred to a calibrated centrifuge tube and made up to 2 ml. After centrifuging for 10 minutes to sediment the small amount of protein precipitated, 1 ml. was transferred to a weighing bottle where it was diazotised and coupled, using 0·1 ml. of reagent; readings were taken using the micro cell of the Spekker absorptiometer.

Results

The results of six experiments in which 10 per cent. solutions of sulphacetamide were applied to one eye, and similar solutions containing 0·1 per cent. duponal to the other eye, are shown in Table I. The drugs were applied for 6 minutes by means of the funnels. The mean results for three similar experiments performed on excised eyes and for three experiments *in vivo* on eyes with denuded corneae are also shown. With solutions containing duponal, the amount of drug in all the tissues is greatly increased. There is no significant difference between the results for the experiments *in vivo* and *in vitro*, except in the case of the conjunctiva; in that tissue there is a higher concentration of the drug in the isolated eye. This difference is probably due to the fact that in the living animal appreciable amounts of the drug are taken by the blood passing through the vascular conjunctiva.

The results for eyes with denuded cornea show that removal of the epithelium leads to a great increase in the permeability of the cornea. The detergent has no effect on the permeability of the denuded cornea, but its effect on the penetration of the drug into the conjunctiva remains, of course, unchanged.

TABLE I

Concentrations of sulphacetamide in the ocular tissues (mg./100 gm.) after the application of 10 per cent. solutions of sodium sulphacetamide with or without detergent in the funnel for 6 minutes.

S + D = 10 per cent. sodium sulphacetamide + 0·1 per cent. Duponal M.E dry.
S = 10 per cent. sodium sulphacetamide alone.

Tissue	Funnel expt. *in vivo* Normal cornea		Funnel expt. *in vivo* Denuded cornea		Funnel expt. *in vitro* Normal cornea	
	S + D mg. %	S mg. %	S + D mg. %	S mg. %	S + D mg. %	S mg. %
Conjunctiva	391	127	531	353	1330	400
Cornea ...	349	191	1250	1190	370	145
Aqueous ...	29·1	6·4	336	422	16·3	4·8
Iris... ...	20·7	14·0	184	238	42·9	18·5
Sclera ...	170	29·3	132	180	202	59·8

The results of the experiments with drops are shown in Fig. 2. The concentration of the drug, in mg./100 gm. of tissue, is plotted against the time elapsing between the instillation of the drops and the removal of the eye for analysis; each point represents the mean of five experiments. In all cases the presence of duponal leads to an increased penetration of the drug into the tissues; the concentrations in these cases then gradually fall to the control values. The aqueous differs from the tissues in that the drug content reaches a maximum after 1 hour as compared with 15 minutes in the tissues; this is probably due to the time taken for the drug to diffuse through the tissues into the aqueous. As might be expected, the external tissues, *i.e.*, the conjunctiva and the cornea, contain more of the drug than the iris and the sclera; the lowest concentrations were found in the aqueous.

Table II shows the results for the *in vitro* experiments with the individual tissues; these results are shown in Fig. 3, in which the uptake of the drug by the tissues in the various experiments are compared. In the intact cornea there is, in the presence of

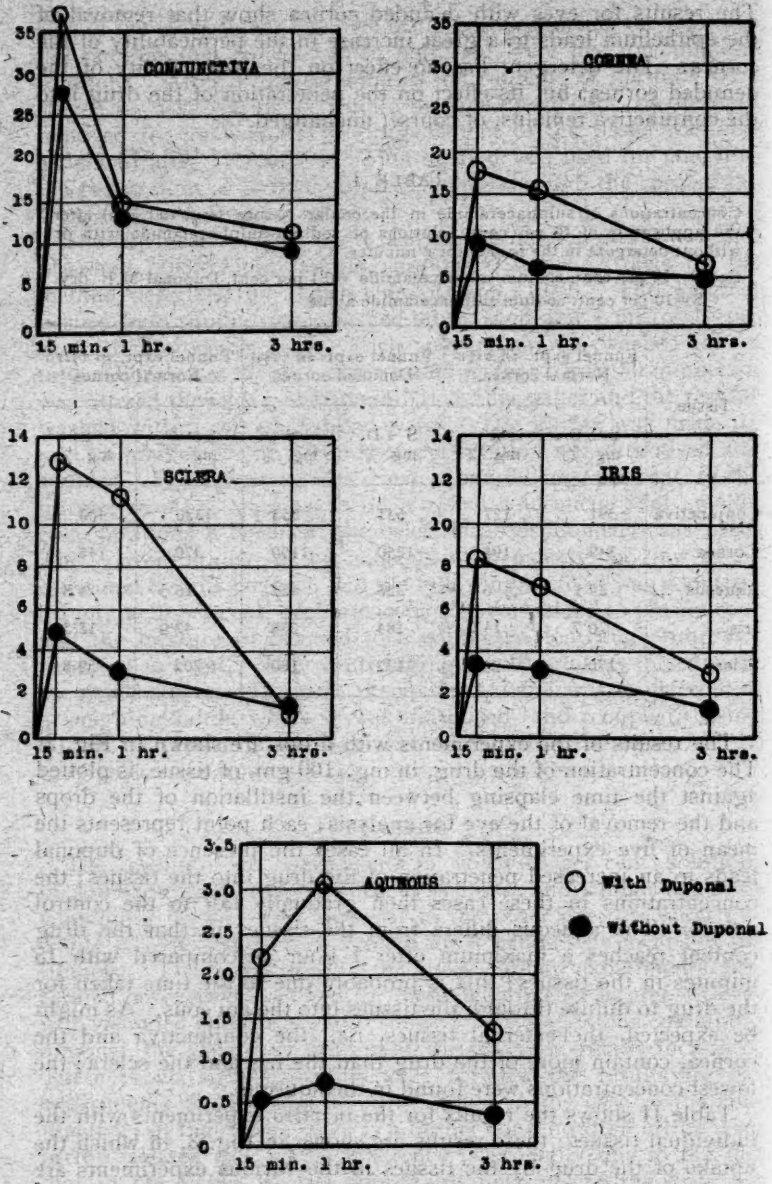


FIG. 2.

Concentration of sulphonamide (in mg. per cent.) in the ocular tissues, 15 mins., 1 hour and 3 hours after the application of 0·1 ml. of a 10 per cent. solution of sodium sulphacetamide alone, and with 0·1 per cent. Duponal.

TABLE II

Showing the effect of Duponal on the passage of sodium sulphacetamide through the cornea *in vitro*. The second and third columns show the concentrations attained in the cornea with and without Duponal, while the fourth and fifth columns show the corresponding concentrations in the artificial a.c. fluid. Each figure is the mean of three results.

Tissue	Concentration of sodium sulphacetamide in mg./100 gm.			
	Tissue after 15 minutes		A.C. Fluid after 15 minutes	
	With Duponal mg. per cent.	Without Duponal mg. per cent.	With Duponal mg. per cent.	Without Duponal mg. per cent.
Intact cornea	803	357	29·5	8·3
Denuded cornea	3440	3620	200	210
Sclera	3240	3660	152	218

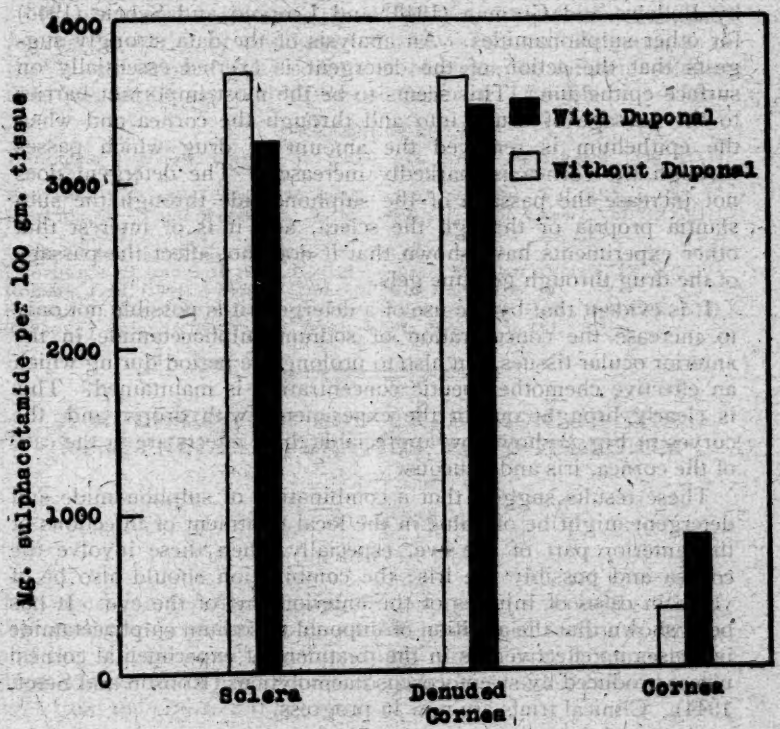


FIG. 3.

Concentrations of sulphacetamide in the sclera, denuded cornea, and the intact cornea, after 15 mins. in a 10 per cent. solution of sodium sulphacetamide, with or without Duponal. Experiments *in vitro*.

duponal, a marked increase both in the amount of drug which is taken up by the tissue, and the amount which passes through it. In the case of the sclera and the denuded cornea (both of which differ from the cornea in that they do not possess an epithelium), there is no increase either in the uptake by the tissue or in the amount passing through, in the presence of duponal. In these experiments the concentrations of the drug reached in the tissue and the anterior fluid were much greater than in those carried out with the intact cornea. It can thus be concluded that the epithelium acts as a barrier to the passage of the drug into the cornea, and the wetting agent may increase the rate of penetration of the drug by overcoming this barrier.

Discussion

These experiments show that by the use of a detergent, the penetration of sodium sulphacetamide into the ocular tissues can be appreciably increased, a result in agreement with those reported by Bellows and Gutman (1943) and Leopold and Scheie (1943) for other sulphonamides. An analysis of the data strongly suggests that the action of the detergent is exerted essentially on surface epithelium. This seems to be the most important barrier to the passage of drugs into and through the cornea and when the epithelium is removed the amount of drug which passes through the cornea is markedly increased. The detergent does not increase the passage of the sulphonamide through the substantia propria or through the sclera, and it is of interest that other experiments have shown that it does not affect the passage of the drug through gelatine gels.

It is evident that by the use of a detergent it is possible not only to increase the concentration of sodium sulphacetamide in the anterior ocular tissues, but also to prolong the period during which an effective chemotherapeutic concentration is maintained. This is clearly brought out in the experiments with drops and the curves in Fig. 2 show how appreciable these effects are in the case of the cornea, iris and aqueous.

These results suggest that a combination of sulphonamide and detergent might be of value in the local treatment of infections of the anterior part of the eye, especially when these involve the cornea and possibly the iris; the combination should also be of value in cases of injuries of the anterior part of the eye. It has been shown that the addition of duponal to sodium sulphacetamide increases its effectiveness in the treatment of experimental corneal ulcers produced by streptococcus haemolyticus (Robson and Scott, 1944). Clinical trials are now in progress.

Summary

1. The penetration of sodium sulphacetamide into the ocular tissues has been studied, both in living rabbits and in isolated ocular tissues.

2. Application of the drug with a wetting agent, Duponal ME dry, increases the penetration of sodium sulphacetamide into and through the cornea.

3. Removal of the corneal epithelium causes a great increase in the penetration of the sulphonamide into and through the cornea, *i.e.*, the epithelium acts as a barrier to the passage of the drug.

4. The wetting agent does not increase the passage of the drug into the denuded cornea (*i.e.*, the cornea with the epithelium removed). It may be concluded that the wetting agent acts by overcoming the epithelial barrier.

5. The results suggest that addition of a wetting agent to sodium sulphacetamide would be of most value in infections of the cornea and iris.

We are greatly indebted to the W. H. Ross Foundation (Scotland) for the Prevention of Blindness, who have defrayed the expenses of the investigation. The sodium sulphacetamide (albucid soluble) used was kindly supplied by British Schering, Limited.

REFERENCES

BELLOWS, J. G. and CHINN, M. (1939).—*Jl. Amer. Med. Assoc.*, Vol. CXII, p. 2023.
BELLOWS, J. G. and GUTMAN, M. (1943).—*Arch. Ophthal.*, Vol. XXX, p. 352.
BRATTON, A. C. and MARSHALL, E. K. (1939).—*Jl. Biol. Chem.*, Vol. CXXVIII, p. 537.
DUKE-ELDER, S. (1927).—*Biochem. Jl.*, Vol. XXI, p. 66.
LEOPOLD, I. H. and SCHEIE M. G. (1943).—*Arch. Ophthal.*, Vol. XXIX, p. 811.
ROBSON, J. M. (1944).—*Brit. Jl. Ophthal.*, Vol. XXVIII, p. 15.
ROBSON, J. M. and SCOTT, A. A. B. (1944).—*Brit. Jl. Exp. Path.*, Vol. XXV, p. 81.
ROBSON, J. M. and TEBRICH, W. (1942).—*Brit. Med. Jl.*, i, 687.

A MODIFICATION AND EXTENSION OF THE McREYNOLDS' OPERATION FOR PTERYGIUM*

BY

Major L. STAZ, S.A.M.C.

M.E.F.

THE operation for the removal of pterygium is probably one of the commonest ophthalmic operations performed in South Africa and the Middle East. The condition occurs more commonly in male adults, but is not uncommon in females and it is seen at all ages from puberty to old age.

Two actively growing types are found:—

(1) The fleshy succulent band of conjunctiva advancing into and across the cornea.

(2) The raised gelatinous head in the cornea with a flat body containing dilated blood vessels.

The first type is the one which usually recurs after operation.

The operation for the removal of a pterygium is usually classed as a minor operation, but experience has shown that it can lead to great disappointment cosmetically, recurrence can take place, and complications and unpleasant sequelae result.

A number of soldiers have returned from North Africa with a newly formed pterygium in one or both eyes and it is probable that the condition, which has been uncommon in the British Isles, will be met with more frequently.

After a trial of the majority of old and new operations advised, including that of Stocker (1942), the McReynolds' was found to be the most suitable. Certain features, however, which will be mentioned below, were found to be unsatisfactory, with the result that an extension of the operation has been evolved by the writer and is described in this article.

The McReynolds' operation and its disadvantages:—(1) After removal of the head of the pterygium from the cornea, the conjunctiva along the lower margin of the body is incised and it is undermined above and below the incision, forming a cul-de-sac towards the lower fornix.

(2) The head of the pterygium is excised and a double-armed stitch is inserted into the neck. The needles are carried subconjunctivally and brought out near the lower fornix in such a way that the body of the pterygium now runs almost vertically instead of horizontally. The blood-vessels in the body are stretched firmly over the sclera so that they become obliterated in the course of time and the pterygium is covered by the conjunctiva of the lower cul-de-sac.

(3) The new direction of the pterygium is arranged so that the raw area at the limbus, left by the removal of the head and neck, is covered by conjunctiva.

(4) If the pterygium is implanted into the lower cul-de-sac in such a manner as to fulfil paragraph 3, the upper conjunctiva frequently becomes folded over the upper and nasal limbal margin. This may lead to a permanent, vascularised adhesion between conjunctiva and the raw area of cornea. It may be the starting point of an actual recurrence.

(5) The upper margin of the conjunctival cul-de-sac, even if stitched to the pterygium, hangs loosely for many weeks and sometimes shrivels into an unsightly lump of conjunctiva.

FIG. 1.

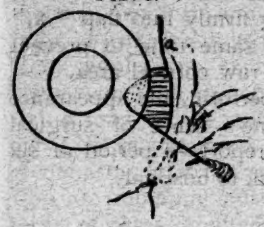
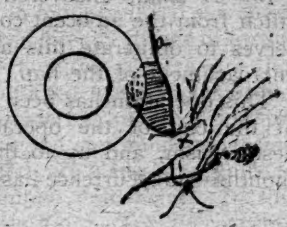


FIG. 2.



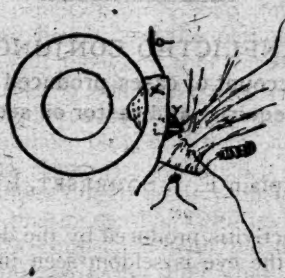


FIG. 3.

The Modified Operation:—(1) After preliminary cocainization of the conjunctival sac, a few minims of Novocain 2 per cent. c Adrenalin or some suitable substitute is injected subconjunctivally at the site of the pterygium and into the lower fornix, as it is found that the latter site is not well anaesthetised by surface application.

(2) The head of the pterygium is shaved off the cornea, excised and implanted into a conjunctival cul-de-sac as in the McReynolds' operation. Care is taken that the body is stretched firmly across the sclera to obliterate the vessels. (Fig. 1.)

(3) The new direction in which the pterygium is implanted does not aim at covering the raw area of sclera at the site of the excision at the limbus; it is placed so that there is no overlapping of the conjunctiva along the upper limbus, if necessary an incision can be made in the conjunctiva at " a " (Fig. 1).

(4) The redundant edge of conjunctiva between the incision and the tied silk stitch is incised as shown in Fig. 2, and a flap " x " is formed.

(5) Flap " x " is turned upwards and stitched to cover the raw area of sclera and to lie along the limbus without encroaching on the cornea. A vertical barrier is thus formed to prevent the recurrence of the growth of horizontal vessels on to the cornea.

(6) A small uncovered area appears at "y" (Fig. 3). A stitch from the adjacent conjunctiva biting firmly into flap "x," serves to obliterate this area and at the same time to prevent encroachment of the flap "x" on to the raw corneal area.

This operation has been found easy to perform, the appearance at the end of the operation satisfies one's sense of surgical aestheticism, and up to the time of this report—a period of six months—no recurrence has yet reported back to hospital.

REFERENCE

STOCKER, F. W.—*Arch. Ophthal.*, Vol. XXVII, May, 1942.

SELF INFLICTED CONJUNCTIVITIS*

An account of cases produced by the jequirity and castor oil seeds

BY

Captain E. J. SOMERSET, I.M.S.

AN artificial conjunctivitis produced by the deliberate introduction of an irritant into the eye is seldom seen in civil practice. The condition is so unusual that it is doubtful if most ophthalmologists would readily diagnose it on seeing a case for the first time. With experience, however, the diagnosis can be made with certainty on immediate clinical inspection, as most cases present a very characteristic appearance. Indeed the diagnosis can often be made in spite of a superadded secondary bacterial muco-purulent conjunctivitis complicating the clinical appearance. A recent paper by King (1942) and the subsequent correspondence it involved shows that the condition is not well recognised and prompts me to record an account of a number of cases recently seen by me. These cases seem to be of particular importance in that in two of them a confession was elicited as to the nature of the irritant substance used, and the cases in which a confession was obtained in no way differed from those in which interference was stoutly and persistently denied.

In civil life if a patient is in hospital, he is at a financial disadvantage and in any case he prefers his home conditions to those he meets in the most comfortable and up-to-date hospital. In the army, however, conditions are different. A soldier loses no pay by being in hospital when on active service and the comforts of hospital life are very considerable compared to those of life in

* Received for publication, October 5, 1944.

an active unit, especially in a jungle area which furnishes few of the usual comforts and amenities found in more civilized surroundings. Furthermore hospitalization affords a ready means of escape from unpleasant experiences and if medical officers are not conversant with the condition, a self-inflicted wound or conjunctivitis may be the means of being transferred to a comfortable depot, or of obtaining sick-leave. With the enormous expansion of the army it is not surprising that there are a few men enlisted who are unhappy misfits, or have criminal tendencies. In this series of cases no attempt has been made to ascertain the psychological background.

Duke-Elder (1938), to whom I am indebted for most of the references, records the following substances as having been used: sand, ashes, aniline pencil, pepper, soap, tobacco, ipecacuanha, the juice of castor oil beans, and the pathological secretions of trachoma. Elliot (1920) mentions that corrosive sublimate and lime are sometimes used by malingerers in India. In the present series the jequirity seed was definitely used in one case, and the castor oil seed in another, both of whom made a confession. Bridgeman (1944) has seen cases in which a lighted match head had been used and others due to the introduction of anti-gas ointment. It is probable that mustard and chillies are other substances occasionally used. In connection with the introduction of lime into the eye it is interesting to note that Leber (1895, 1900) described the condition produced as a new disease of unique pathology and named it conjunctivitis petrificans. Other cases were reported by Reif (1900), Koster (1901), Posey (1903), Saemisch (1904), but the true aetiology appears to have been elucidated by Sidler-Huguenin (1913), Wirths (1918) and Chaillous (1929). In these cases plaques of the carbonate, phosphate, or sulphate of lime were found embedded in the conjunctiva, surrounded by an inflammatory reaction with considerable fibrous tissue formation.

In the present series of cases a confession was obtained from two; one had used castor oil seed, the other jequirity seed.

The castor oil plant

The castor oil plant, syn., palma christi, ricinus communis belongs to the natural order euphorbiaceae; sub-order crotoneae (Encyclopaedia Britannica 9th Edition) and grows in most tropical countries. It varies from a shrub to a tree 30 to 40 feet high. The fruit consist of a tricoccous capsule covered externally with soft yielding prickles. It is green in colour and contains three seeds. The seeds (Fig. 1) vary in size but are usually about $\frac{3}{4}$ inch long, $\frac{1}{2}$ inch broad, and $\frac{1}{4}$ inch thick. They are oval in shape and have

a hard shiny brown capsule, on which is a symmetrical design in lighter and darker shades of brown. Inside is a fairly hard homogeneous yellow substance. From this is expressed the crude oil, which in India, is used for illumination as well as for purgation.

That the inner seed is capable of producing a conjunctivitis is shown by the following personal experiment:

April 13, 1943 (Evening).—A castor oil seed was removed from its outer case and cut in half. In front of a mirror the left lower lid was everted and the cut surface of the seed was held against the tarsal conjunctiva, care being taken to elevate the eye so as

FIG. 1.

Castor oil seed.

not to endanger the cornea. At the end of fourteen minutes continuous application the conjunctiva was seen to be slightly hyperaemic over the area where the seed had been applied. At this time there was no pain, epiphora or discomfort of any sort.

April 14, 1943.—On waking in the morning the lids were found to be sticking together but the discharge was only slight. The area of damaged conjunctiva was somewhat more hyperaemic and had spread slightly in all directions. That evening some discomfort was felt in the eye, and on inspection there was a pseudo-membrane in the area where the seed had been placed. The lower half of the conjunctiva, both lid and bulbar, was hyperaemic, but in striking contrast the upper half was its normal colour.

April 15, 1943.—Condition much the same. The day's work was done with some discomfort. Argyrol 10 per cent. drops were occasionally instilled. There was a small amount of muco-purulent discharge.

April 16, 1943.—The pseudomembrane came away leaving a slightly ulcerated, but considerably hyperaemic conjunctiva beneath.

April 19, 1943.—Eye healed.

The jequirity plant

The Jequirity plant or Arbus precatorius, syn: latur mani (Assam), kunch (Bengal), gunja (Hindi), crabs' eyes, is a small shrub of the order leguminosae (Kanjilal, 1938). The seeds are spherical, about ¼ inch in diameter, and are usually of a brilliant shiny scarlet colour with a small shiny jet-black cap extending over a quarter of the surface. They are extremely hard. Rarely

FIG. 2.

Jequirity seed.

they may be white with a black cap, or sometimes wholly white or wholly black. Inside the outer capsule there is a hard yellowish homogeneous substance. The seeds (Fig. 2) are said to weigh constantly about 1·75 grains and are used by Indian jewellers as their lowest unit of weight. They are commonly called rutti or gumchi seeds. Tandon (1943) states that he has seen the decapsulated seeds packed into the cervical canal in a woman who came to post-mortem examination following abortion. The whole lining of the cervical canal had sloughed.

In order to demonstrate its irritant nature a seed was removed from its outer covering and cut in half. The cut surface was applied to the lower tarsal conjunctiva of the right eye of a rabbit, one evening, for several minutes duration. Next morning there

was seen to be a considerable muco-purulent discharge, the conjunctiva was very red, both above and below, and was sloughy in the area where the seed had been applied. The other eye was normal.

Clinical signs

Of 31 cases seen the condition was unilateral in 19 (8 right eye only, 11 left eye only), and bilateral in 12. The malingerer usually spends considerable thought upon his condition, which probably explains why the signs were bilateral in such a high proportion of the cases. All were Indian other ranks, none of whom had gained N.C.O. rank. They came from widely differing units, situated at considerable distance from each other. It is interesting to note that the four British cases described by King were likewise

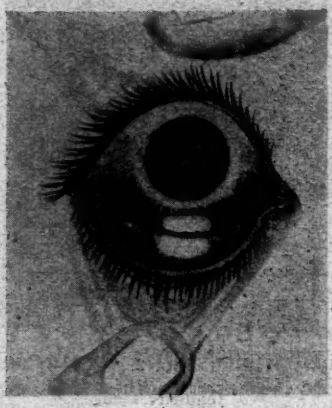


FIG. 3.

men who were still privates. It is thought that the majority of the cases were due to the use of the castor oil or jequirity seed.

Typically the patient keeps the eye closed and frequently shows a very guilty and sulky appearance. He is unco-operative in responding to his vision test and will refuse to count the dots on the illiterate test type or says the wrong number of dots all the way down the board.

Three main clinical types are seen, as follows :—

Sub-acute type (Fig. 3).—The eye on examination shows considerable epiphora with a little muco-purulent discharge. On everting the lower lid there is a sloughy area about a $\frac{1}{4}$ by $\frac{1}{4}$ inch on the tarsal conjunctiva extending into the lower fornix.

Sometimes there is an identically shaped area immediately opposite on the bulbar conjunctiva as if a piece of irritant substance had been placed inside the lower lid which had then been allowed to regain its natural position thus bringing the irritant into contact with the bulbar conjunctiva. Surrounding the necrotic sloughy or pseudomembranous area is seen considerable hyperaemia and the whole of the lower half of the conjunctival membrane is oedematous. In contrast the upper half of the conjunctiva is striking in its normality.

Hyper-acute type (Fig. 4).—In this type in which the irritant has been allowed to remain in the eye for a longer period there is

FIG. 4.

seen to be intense epiphora, moderate discharge and the lower fornix contains a large slough. The whole of the conjunctiva is oedematous as are also the lids. The upper half of the conjunctiva is hyperaemic but to nothing like the extent of that seen in the lower half. There is a striking difference between the upper and lower half of the conjunctiva. In some cases the whole of the lower fornix is a sloughy mass. A pseudomembrane is occasionally seen on the upper tarsal conjunctiva.

Chronic type (Fig. 5).—In these cases the chemosis of the conjunctiva, and oedema of the lids is absent and the upper half of the conjunctiva is normal. In the lower fornix is seen a patch of chronic conjunctivitis with a varying amount of fibrosis. There may be some degree of symblepharon. This is the condition seen when the case is nearly healed.

Bridgeman (1944) informs me that there is yet a different method of using the jequirity seed which gives a still different clinical

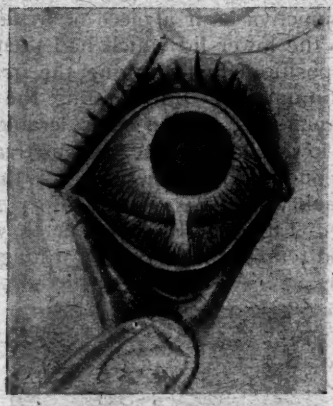


FIG. 5.

picture. The seeds are ground up into a powder and placed in a small bag and soaked in hot water. The man now lies down on his back and places the bag on his closed lids. The irritant soaks out producing a fairly intense chemosis of the lids and a diffuse conjunctival engorgement with a varying degree of corneal haze.

Pathology

During the last war the histology of many cases of self-inflicted conjunctivitis was investigated by Fromaget and Harriet (1916), Cosse and Delord (1917), Pereyra (1917), Semperi (1917), Krautschneider (1918), Morandi (1922), Miceli (1922), and others. The essential features seem to have been the absence of pathogenic bacteria, the usual presence of eosinophilia and the presence of minute particles of the foreign substance. In the present series a number of smears from the conjunctiva of the more recent and acute cases were made.

Characteristically the slide is packed with polymorphonuclear leucocytes to the exclusion of almost all other cells. The cell membrane gave the appearance of not having been in contact with bacteria or their toxins, for almost all the cells were well formed, stained well and appeared as if they came from normal blood. There was a striking absence of degenerate and dead leucocytes, nor could any pathogenic bacteria be found except in one case. Cultures were made from a few of the recent and acute cases and in only one case was a growth of abnormal bacteria obtained. A preponderance of eosinophils was not noted. In

one case in which there was a super-added acute mucopurulent conjunctivitis, Gram-negative intra and extra-cellular diplococci were seen. Soon after examining the slide on my return to the ward I was informed that the patient had confessed to having put jequirity seed into the eye, and indeed jequirity seeds were found hidden in his pillow case. The patient did not show signs of urethral gonorrhoea. The case showed that the condition could be diagnosed quite easily in spite of a superadded bacterial infection.

Diagnosis

It is unlikely that an acute inflammatory process in the conjunctiva could confine itself entirely to one part of that membrane. The flow of the tears and the movements of the lids in blinking makes this impossible. In any acute bacterial conjunctivitis the upper half of the conjunctiva is almost as much injected as the lower. Another striking feature of these cases is the nature of the discharge. The lids are not stuck together and covered with the typical yellowish discharge of an acute conjunctivitis. The actual discharge of the lids is scanty especially in comparison with the sloughy area on the conjunctiva. In contradistinction the amount of epiphora is excessive and is more in harmony with an inflammation of the cornea, iris or lacrymal sac. As would be expected sulphanilamide has no effect upon the clinical picture.

Another point in the diagnosis is the rapidity with which the condition heals with appropriate treatment. If the medical officer is not conversant with the condition it is remarkable how the eye will suddenly flare up on the patient learning that he is to be discharged from the hospital the next day.

Corneal involvement is uncommon and was only seen in two cases, in one of which considerable nebula formation resulted.

Differential diagnosis

Dacryo-cystitis with purulent regurgitation into the conjunctival sac will produce a hyperaemia of the lower half of the conjunctiva in contradistinction to the upper half, but no slough is ever produced and the condition is readily diagnosed by pressure on the lacrymal sac. Trauma is easily excluded. Patients will often say that they accidentally struck their eye on a branch of a tree. This accident would, however, show a lesion of the skin of the lids or a corneal abrasion. It is quite impossible for a branch of a tree to injure the lower fornix without injuring the cornea or the skin of the lower lid.

In membranous conjunctivitis the patient is usually ill with some fever and the conjunctival smear and culture will show

pathogenic organisms. The sulpha group of drugs markedly improve those cases due to pneumococci or streptococci, while in the self-inflicted cases they are without effect. Cases of chronic or recurrent pseudomembranous conjunctivitis have been reported by Hulme (1863), Knapp (1883), Critchett and Juler (1883), Howe (1897), de Schweinitz (1924), Castroviejo (1935), in which a pseudomembrane persisted or recurred many times over long periods of many months and were extremely persistent to treatment. Adequate treatment of self-inflicted conjunctivitis cures the condition very rapidly.

Treatment

The lids and conjunctiva are cleaned up once or twice a day with normal saline, and a bland ointment instilled to prevent symblepharon. Provided there are no fresh applications of the irritant substance, the symptoms and signs will clear up in 3 to 10 days. Corneal involvement will require appropriate treatment.

Summary

1. The clinical signs of self-inflicted conjunctivitis due to the introduction of the jequirity and castor oil seeds into the lower conjunctival sac are described.

My thanks are due to the D.M.S. India for permission to publish this paper.

REFERENCES

BRIDGEMAN.—Personal Communication. 1944.
CASTROVIEJO.—*Arch. de Oftal. Hisp.-Amer.*, Vol. XXXV, p. 634, 1935.
CHAILLOUS.—*Bull. Soc. d'Ophtal., Paris*, p. 287, 1929.
COSSE and DELORD.—*Ann. d'Ocul.*, Vol. CLIV, p. 152, 1917.
CRICHETT and JULER.—*Trans. Ophthal. Soc U.K.*, Vol. III, p. 1, 1883.
DUKE-ELDER.—Text-book of Ophthalmology, Vol. II, London, 1938.
ELLIOT.—Tropical Ophthalmology. London, 1920.
FROMAGET and HARRIET.—*Ann. d'Ocul.*, Vol. CLIII, p. 388, 1916.
HOWE.—*Trans. Ophthal. Soc U.K.*, Vol. VIII, p. 36, 1897.
HULME.—*Med. Times and Gaz.*, 1863.
KANJILAL.—Flora of Assam, Calcutta, 1938.
KING.—*Brit. Jl. of Ophthal.*, Vol. XXVI, p. 467, 1942.
KNAPP.—*Arch. f. Augenheilk.*, Vol. XII, p. 61, 1883.
KOSTER.—*Ned. Tsj. Gen.*, Vol. XXXVIII, p. 1214, 1901.
KRAUTSCHNEIDER.—*Wien. Med. Wochenschr.*, Vol. XXXI, p. 1146, 1918.
LEBER.—*Bull. Ophthal. Gesell., Heidelberg*, Vol. XXVI, p. 46, 1895.
——— *Arch. f. Ophthal.*, Vol LI (I), p. 1, 1900.
MICELI.—*Gior. di Ocul.*, Vol. III, p. 10, 1922.
MORANDI.—*Giorn. di Med. Milit.*, Vol. LXIX, p. 237, 1921.
PEREYRA.—*Ann. di Ottal.*, Vol. XXIV, p. 341, 1917.
POSEY.—*Ann. d'Ocul.*, Vol. CXXIX, p. 277, 1903.
REIF.—*Arch. f. Ophthal.*, Vol. L, p. 70, 1900.
SAEMISCH.—*Graefe-Saemisch Handbuch.*, Vol. II, V (I), p. 539, 1904.
DE SCHWEINITZ.—Diseases of the Eye. Philadelphia, 1924.
SEMPERI.—*Ann. di Ottal.*, Vol. XXIV, p. 265, 1917.
SIDLER-HUGUENIN.—*Arch. f. Augenheilk.*, Vol. LXXIII, p. 167, 1913.
TANDON.—Personal Communication.
WIRTHS.—*Klin. Monatsbl. f. Augenheilk.*, Vol. LXXI, p. 606, 1918.

INTRA-OCULAR FOREIGN BODIES*

BY

W. O. LODGE

HALIFAX

Localisation

The first essential for dealing with foreign bodies within the eyeball is exact localisation. (Cf. " La cataracte, c'est l'incision.") Among the most important cases are those in which the vision of the injured eye is good, but the foreign body is too far forward to be seen with the ophthalmoscope. For these, my method of projection is as follows (see Fig. 1).

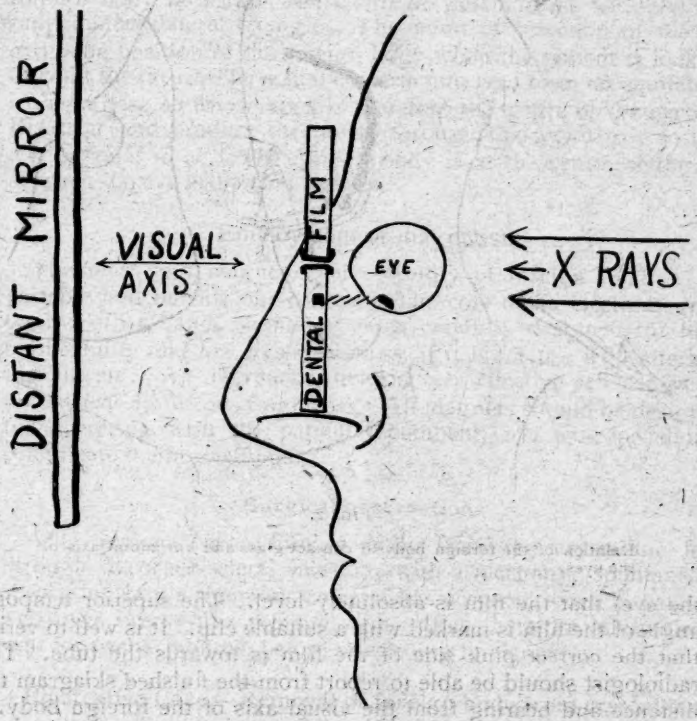


FIG. 1.

Relation of the foreign body to visual axis in an eye in which there is good vision.

*Received for publication, October 5, 1944.

In the dark room a metal bush or eyelet is punched through a dental film, complete in its original coverings. In the X-ray room, the cylinder of the X-ray tube is pointed at its own reflection in a mirror on the wall. The patient's head is next interposed. He must watch in the mirror through the pin-hole (held close to

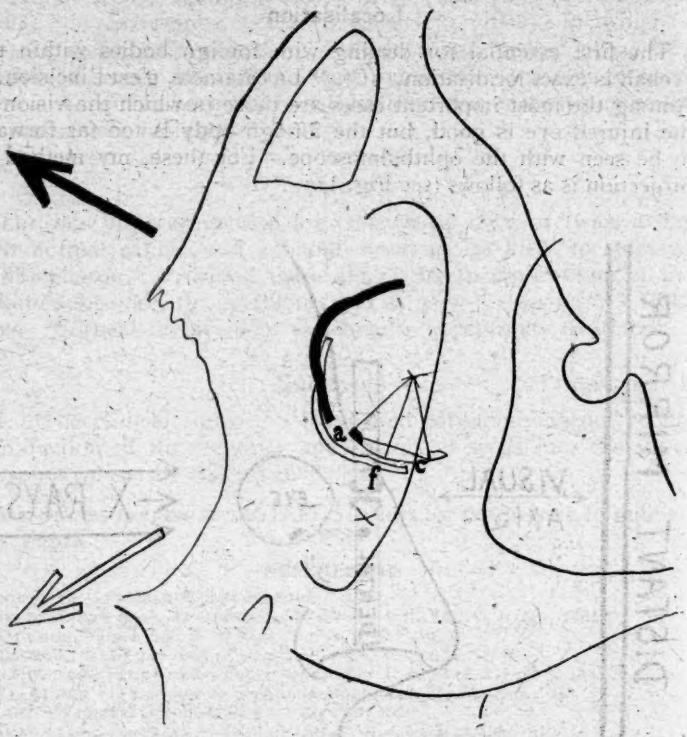


FIG. 2.

Relation of the foreign body to contact glass and horizontal axis of the eyes.

the eye) that the film is absolutely level. The superior temporal angle of the film is marked with a suitable clip. It is well to verify that the correct pink side of the film is towards the tube. The radiologist should be able to report from the finished skiagram the distance and bearing from the visual axis of the foreign body.

If the vision be lost, a contact glass is put in the eye, and with a side to side projection, two consecutive exposures are made on the same film (see Fig. 2), the patient looking with the other eye first at one and then at another marked point on the wall in the same

plane as the film. The distance between these two fixation points should be equal to their radial distance from the centre of the eye. The radiologist is now able by putting a halfpenny on the finished film, to outline the eyeball and to report the distance and bearing of the foreign body from the horizontal axis of rotation of the eyes. Antero-posterior projections are misleading if made without visual fixation with the other eye, but one can estimate the error from the shadow of the contact glass.

If a contact glass be not available, a geometrical construction is substituted, but the slightest movement of the skull must be prevented. With the patient lying down on the injured side, let the visual axis turn through 60 deg. parallel to the sagittal plane. Then the foreign body rotates through 60 deg. in a horizontal plane. The path traced out by corresponding points on the foreign body is an arc, the chord of which forms with the two radii an equilateral triangle. The point of bisection of the arc gives the position of the foreign body when the patient is looking directly forward. The actual construction is to form an equilateral triangle base ac whose apex is therefore the centre of the eyeball. Bisect ac and produce the radius through this point to f so that o.f. is equal to ac. The foreign body is at the centre of the arc ac when the eye is directed forward.

Employment of magnetism

The mass and magnetic susceptibility of foreign bodies are variable and outside our control. The core of an electromagnet, on the other hand, should be most carefully designed for high permeability and low hysteresis loss, if it is for use with alternating current. An alternating field is very effective at close range for extricating ferrous fragments. All magnets should be designed for operating with the patient recumbent, lest syncope should complicate the proceedings.

Surgical observations

After removal of a foreign body from the crystalline lens through a corneo-scleral incision, with iridectomy, spontaneous absorption of the traumatic cataract has occurred, even in patients well over twenty-five years of age. It is therefore advisable to wait for twelve months, before proceeding to extraction.

Illustrative Case.—Removal of foreign body from crystalline lens. Spontaneous absorption of traumatic cataract

W. A., aged 33 years, an underground fitter, complained on January 27, 1942, of dimness of vision in the left eye of six weeks duration. He had no recollection of injury. On examination, a

steel foreign body about the size of a pin's head was visible in the left crystalline lens, which was becoming opaque. Under local anaesthesia, a keratome incision was made superiorly. Iridectomy was performed and the foreign body was removed with an A.C. hand magnet. No lens substance escaped. On June 30, 1942, his name was provisionally put on the waiting list for extraction of cataract (left), "in about six weeks." On October 15, 1942, the cataract was mature but showed signs of shrinking, leaving a clear zone inferiorly. His name was crossed off the waiting list. On June 22, 1943, the left vision with plus 12·0 spherical was 6/18, and on February 15, 1944, with plus 13·0 spherical, 6/9.

Foreign bodies often go right through the eyeball and come to rest in the fascia bulbi. The prognosis is favourable in such cases. In searching for a wound of exit far back in the sclera, a small endoscope is of service.

Sites of election for incisions are posterior to the insertion of any of the rectus muscles. Temporary tenotomy (see Fig. 3) gives good access. When reunited, the muscle keeps the scleral wound from gaping. Unless vitreous is lost the scleral suture is withdrawn—not tied—lest it wrinkle the sclera, or predispose to infection.

Security of an intact fellow eye is the paramount consideration.

Conclusion

Ophthalmic skiagrams should be as informative as navigational charts.

Simple devices in connection with the treatment of intra-ocular foreign bodies have been described and illustrated.

ANNOTATIONS

The Lighting of Buildings

Ophthalmologists are sometimes consulted on problems which lie outside the limits of ordinary medicine and surgery, but which are important items of preventive medicine. They are often ill-equipped to answer the questions put to them; and in the hurly-burly of hospital and private practice they are scarcely to be blamed. It would be well, however, if some ophthalmologists at any rate would devote special attention to these subjects, which bid fair to loom larger in the future. One such is the lighting of buildings. A few ophthalmologists have indeed paid considerable attention to the lighting of schools. These alone realise the great complexity of the

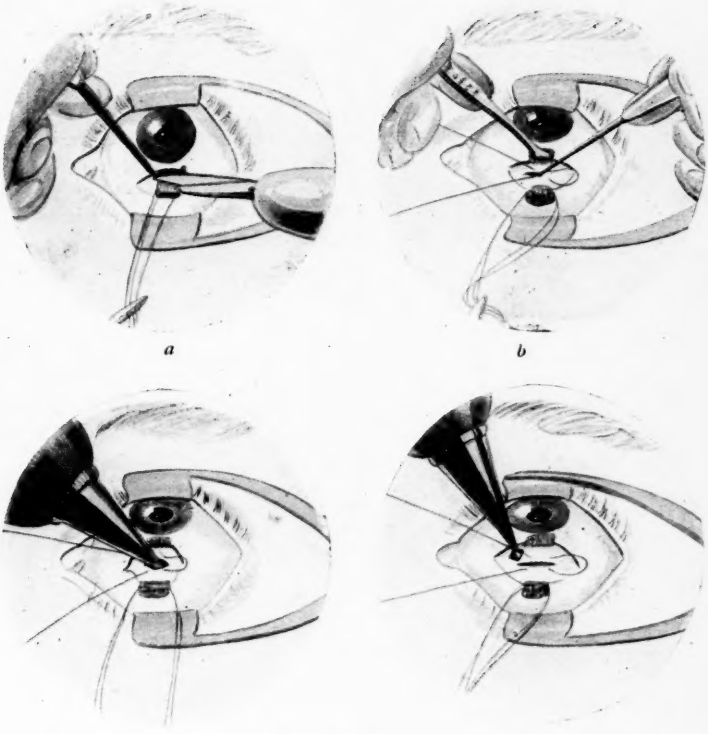


FIG. 3.

Removal of intra-ocular foreign body. There was a minute scleral wound of entry (not shown) at twelve o'clock.
(*a*) Conjunctival incision and temporary resection of the inferior rectus.
(*b*) Sclera examined. No wound of exit found. Scleral suture inserted. Incision by cutting spark or keratome. (*c*) Approach of electro magnet.
(*d*) Foreign body removed. Wound closed. This patient eventually regained 6/6 vision.

Skiagram of intra-ocular foreign body. Between two exposures, the eyeball is rotated through 60°. The two images of the foreign body and the centre of rotation of the eye are therefore equidistant. The contact glass augments the demonstration.

problems which arise in ensuring adequate illumination—natural and artificial—in rooms devoted to such various uses as schoolwork, sewing, cooking, reading, and so on, not to mention the satisfaction of the psychological factors which conduce so largely to comfort and well-being.

It is, therefore, fitting that the *British Journal of Ophthalmology* should draw special attention to a Report by the Lighting Committee of the Building Research Board of the Department of Scientific and Industrial Research on "The Lighting of Buildings" (H.M. Stationery Office, 2/6 net). The Committee, under the Chairmanship of Dr. C. C. Paterson, F.R.S., included an architect and members of the Illuminating Engineering Society, of whom Mr. H. C. Weston is most familiar to readers of the *British Journal of Ophthalmology*. Unlike its predecessor, the Factory Lighting Committee of the Home Office, there was unfortunately no ophthalmologist or physiologist upon it. The Report is by far the most comprehensive and authoritative exposition of the methods of providing satisfactory lighting, both daylight and artificial, of buildings, and of the methods of measurements and principles of design, which has yet appeared. If we draw attention to a few outstanding features it is chiefly with a view to encouraging the study of it as a whole.

There has been great advance in the theory and practice of Daylight Lighting in recent years, largely due to the introduction of the "daylight factor" in measurements by Messrs. P. J. and J. M. Waldram. The sections on the design of windows and siting of buildings for daylight are masterly. Standards of daylight illumination in different rooms are adequately dealt with; and the vexed question of artificial light as a supplement or substitute for daylight is discussed, as well as the control of direct sunlight. There are a large number of admirable recommendations.

The Committee is to be heartily congratulated on its work, which cannot fail to have a beneficial effect on post-war building and the amelioration of existing conditions. Architects in the past have been unduly concerned with the artistic qualities of their designs, neglecting to some extent the details of utilitarian, and especially physiological, requirements. The recommendation that "the Board of Architectural Education and the Town Planning Institute should include a study of lighting in the subjects of their qualifying examinations" will have a tonic and astringent effect.

Reviews and Reviewers

Those who have read an entertaining ghost story by the late M. R. James entitled "Casting the Runes" will remember the terrible ending of a poor gentleman who published a scathing

review of a book in a scientific journal. The review was not signed by the writer but the "rune caster" had his own methods of discovering such matters. The reviews in our pages are usually anonymous, but this is not due to a fear of any disgruntled author casting the runes either on the author or the editors. Of course it occasionally happens that a book comes in for review which is above the mental capacity of the ordinary reviewer, but this does not often happen and for the most part any of us is capable of reviewing a text-book of ophthalmology. Should a reviewer be in any doubt as to how to review a book some would recommend the method of the man who misquoted Pope: "praise with faint damns." To call attention to typographical errors is a favourite practice with some reviewers, but this method can be overdone, as a certain number of mistakes of this nature must be allowed for in the publication of all printed matter.

Some people are content to read the preface and to construct their review from this; others fly to the index and try to catch the author napping over the page references.

Most books, we believe, make their way independently of good or bad reviews and if any one is depressed at the small sale of his book he can console himself with the remembrance that "Vanity Fair" was very slow indeed at its start.

ABSTRACTS

I.—RETINA

(1) **Gradle, H. S. (Chicago).—Concerning detachment of the retina.** *Amer. Jl. Ophthal.*, Vol. XXVI, p. 524, 1943.

(1) **Gradle** discusses seven points in the treatment of retinal detachment. (1) Pre-operative immobilization. The affected eye is atropinized, both eyes are bandaged and the patient's posture is such that the deepest part of the detachment is placed in the most dependent position attainable. Very rarely does spontaneous replacement of the retina result from this. In many, some of the inter-retinal fluid is absorbed and the eyes thus rendered more favourable for operation. Five to ten days is seldom time wasted in this treatment.

(2) In some cases of retinal detachment the pupil fails to dilate to any mydriatic more than 4mm.

(3) Visual result after macular separation. The author believes that this is influenced by the duration of the detachment and the

patient's age. Under 25 years of age cystic degeneration at the macula is unlikely. In adults this complication seems to be more likely if the macula has been off for more than one week.

(4) Post-equatorial exposure of the sclera. Two alternatives are open to the surgeon, either tenotomy of an extra-ocular muscle and re-suture at the end of operation, or traction on the muscle by means of a bridle suture. The author comments that the former seldom results in permanent "tropia or phoria" whereas forcible traction by the latter technique may damage the muscle origin and so give rise to such a complication.

(5) A clear cornea during operation. Towards the end of the operation the cornea may become hazy due to rise of intra-ocular pressure. The author recommends three fine needle punctures of the sclera under 2·5 millamperes of positive catholysis. The resultant seepage during operation keeps down the intra-ocular pressure.

(6) Juxta-position of the retina and choroid. The thorough evacuation of inter-retinal fluid and its drainage is emphasized as a necessity for the formation of choroido-retinal adhesions. Trephining, penetrating diathermy and scleral puncture with a Graefe knife are compared.

(7) Post-operative care. Rest in bed for 14 days is advised followed by 10 to 14 days in a wheel chair, then convalescence at home for a month and a return to sedentary occupation three months after operation. Fourteen days after operation "hole" spectacles with 3 to 4mm. diameter aperture are worn for two months and this is increased every three weeks until the diameter is 1·5cm. The latter size is worn up to 5 or 6 months after operation.

H. B. STALLARD.

(2) **Benedict, W. L. and Parkhill, E. M. (Rochester, Minnesota).—Glioma of the retina in successive generations.** *Amer. Jl. Ophthal.*, Vol. XXVI, p. 511, 1943.

(2) **Benedict** and **Parkhill** review the large literature which gives evidence of glioma retinae affecting successive generations. Not only is transmission direct from affected parent to child, but collateral branches of a family may be affected through non-demonstrating parents. The authors report four cases, and in two of these retinal glioma occurred in successive generations.

H. B. STALLARD.

II.—MISCELLANEOUS

(1) **Cogan, D. G. (Boston, Massachusetts).—Clearing of edematous corneas by glycerine.** *Amer. Jl. Ophthal.*, Vol. XXVI, p. 551, 1943.

(1) **Cogan** describes the value of glycerine drops in clearing the cornea when clouding is due to simple epithelial oedema. It has no appreciable effect on stromal opacity. Clearing occurs in 20 to 30 seconds and lasts several minutes.

The author has found it useful in the examination of acute congestive glaucoma. He has noted no toxic changes resulting from its use. The effect is like that of other hypertonic fluids, the removal of excess water from the hydropic epithelium. No permanent beneficial effect is obtained from its repeated use. The author recommends it merely as a diagnostic aid.

H. B. STALLARD.

(2) **Terry, T. L. (Boston).—Some clinical applications of fluorescence in relation to melanotic pigment.** *Amer. Jl. Ophthal.*, Vol. XXVI, p. 536, 1943.

(2) **Terry** comments that the reason why hidden or obscure freckles in the skin or conjunctiva are so dramatically demonstrated under filtrated ultra-violet light in the rich brown colour of melanin is not obvious.

Under filtered ultra-violet light from the mercury vapour lamp, relatively unpigmented tissues containing potentiality for pigmentation, such as unpigmented melanomata almost invariably appear to be heavily loaded with rich brown pigment. The author states that this finding may be of real clinical value.

H. B. STALLARD.

BOOK NOTICE

Neurology of the Eye, Ear, Nose and Throat. By E. A. SPREGIL, M.D. and I. SOMMER, M.D. New York: Greene and Stratton. 1944.

The section on neurology of the eye contains information which should be valuable to the advanced student who already has a good knowledge of ophthalmology. Ocular movements and their disturbances are described and well correlated with cerebral anatomy and there is an excellent chapter on the smooth muscles of the eye and orbit. The description of fundus conditions is rather confused and disorders of convergence and divergence are discussed with only a bare reference to the theories and practice of orthoptics. A comprehensive bibliography is to be found at the end of the book. The illustrations are good, but their annotation is poor.

CORRESPONDENCE

THE FACULTY OF OPHTHALMOLOGISTS

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—The formation of the Faculty of Ophthalmologists appears to me to come at an inopportune time. To increase the number of organisations to watch over ophthalmologists' interests is to invite division of effort and confusion of thought.

I do not like the Faculty's proposal to have two kinds of members. We want to encourage the younger men, and the suggestion that only six members of Council are to be elected by the Associate members, that is, those of two to five years standing, and others of more seniority, who are not on the staff of a Hospital of arbitrary size, while the older members elect fifteen, is undesirable.

How can the Faculty be fully representative if it excludes the part-time ophthalmologist, whose numbers are indeed, far higher than those of the full-time practitioner? It is from these "part-timers" that we must expect much help in the proposed National Health Service, for without them we shall be unable to put forward a scheme for a medical examination for every patient, for which the Government has expressed a desire.

"United we stand, divided we fall." The ophthalmic group of the B.M.A. is surely best constituted to be the guardian angel. It is democratically elected and all electors of equal status, whether practising ophthalmology wholly or predominantly, and is, therefore, fully representative. Let all ophthalmologists rally round the B.M.A., attend the regional meetings and put their views and desires before their representative on the ophthalmic group committee. By so doing, we present a united front to the Minister of Health when the time comes.

Yours faithfully,

C. R. DUNCAN LEEDS.

EDINBURGH
February 19, 1945.

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

SIR,—Ophthalmologists are agreed as to the need for a united body to represent the profession in all its aspects. At present, three bodies, the Ophthalmic Group Committee of the B.M.A., the Council of British Ophthalmologists and the Association of British Ophthalmologists all profess to be interested in medico-political affairs. It was hoped that the recent negotiations between representatives of the C.B.O. and the A.B.O. would produce the desired body, and general regret will be felt at the apparent failure.

The A.B.O. has not yet decided on its attitude to the proposed Faculty published by the C.B.O., but as a member of its negotiating committee I cannot but fear that this proposed Faculty, instead of uniting the profession and producing the desired united body, will intensify distrust and make more difficult that unity which is so essential today. The circumstances in which this Faculty has been registered, the obvious lack of consideration of detail and the haste with which it has been foisted on the profession give rise to much uneasiness.

Of the many additional objections which will be raised, three may be mentioned. (1) A Faculty is not the proper body to deal with medico-political affairs. A Faculty is generally regarded as an academic body, as witness the recent Faculties of Radiology and Homoeopathy. (2) The proposed Faculty makes no provision for part-time Ophthalmologists. The united body that is required should not only deal with Ophthalmology in all its aspects, but should cater for every section of the profession. (3) The democratic character of the proposed Faculty is in doubt. "The Council shall call an annual general meeting of the Faculty to receive and discuss its report," p. 108. Alongside this it is only fair to place a recent decision of the C.B.O., namely, "Decisions or recommendations of any mass meeting of members or associates should be considered by the Council but should not necessarily be acted upon nor implemented."

These difficulties are not insurmoutable, and I do not despair of the formation of a body acceptable to all parties. To secure this, and I write to suggest that another effort be made by calling together representatives, say, four in number, from each of the three bodies, the O.G.C., the C.B.O., and the A.B.O., and that under an independent Chairman they tackle the problem afresh. Meantime the present proposals for a Faculty should be held in abeyance.

Yours faithfully,

J. N. TENNENT.

GLASGOW,
February 17, 1945.

DARK ADAPTATION IN DETECTING VITAMIN 'A' DEFICIENCY

To the Editors of THE BRITISH JOURNAL OF OPHTHALMOLOGY.

DEAR SIRS,—I risk these comments on "Studies in dark adaptation as a means of detecting deficiency of Vitamin 'A'" published in your Journal of November, 1944, being mistakenly provocative because the matter is so obviously important to the

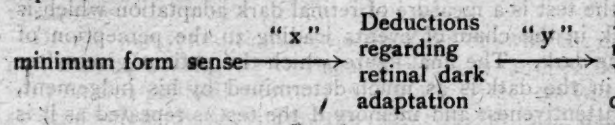
ophthalmologist, physician and manufacturer. Although some of this criticism is anticipated in the paper the general effect of it is to continue thought and conclusion along a definite direction.

The minimum form sense is taken as a reliable measure of retinal dark adaptation. In fact is it so? the evidence makes it a doubtful assumption. Although the minimum form sense as found with the adaptometer is an indication of one's ability to see in the dark under the fixed circumstances in which the test is carried out, it does not follow that the test is a measure of retinal dark adaptation which is only one link in the chain of events leading to the perception of objects in the dark. The final figure which the patient gives after 30 minutes in the dark is as much determined by his judgement, confidence, attentiveness and memory if the test is repeated as it is by any peripheral retinal process. On no grounds other than this complexity of factors can one explain the experience of many clinicians than one individual may give different readings at different sessions although there is no reason to suspect any change in the individual's health; that the subject who sees well enough to go about in the dark may give a poor minimum form sense return when tested on the instrument; that he on the other hand may see poorly in the dark when going about his tasks yet give a fairly good minimum form sense return; and finally that a poor minimum form sense may be obtained although there is absolutely no evidence of disease in eye or body. This being so one cannot use this test to determine the degree of retinal dark adaptation without expecting a high margin of error. Indeed for the individual without obvious eye disease it can be claimed almost as much by the psychiatrist as a test of mental state as by the oculist to measure the retina's ability to adapt in the dark.

It is on such sand that the authors have built, and the shifting nature of the foundation can well explain the changing shape of the edifice. For example the 147 workers who were keen enough to co-operate by taking the pellets and showed a slight average improvement of 0·073 log. units were probably the brighter component of the group selected. Keyed up to the occasion like students who have properly studied for their examination they looked for success and saw it. Even so 46 showed no change and 28 deteriorated. It is not at all surprising that the 188 indifferent (or perhaps unwilling) co-operators, who because they did not take the pellets were used as controls, showed no great average improvement. Yet nearly one third of them improved and what seems even more significant 49 deteriorated. Why? It can well be argued that psychological differences between and within the groups supply the explanation for the difference between the average improvement in the groups and the very marked variation inside each group. Memory, judgement and eagerness although not so measurable in international units nor so seizable as the handy pellet

may well have been placed in the dock instead of the accused changes in the peripheral retinal process. The same type of interpretation can be applied to the differences found among the school children.

Further, conclusions are drawn regarding the vitamin 'A' condition of various groups of children and adults from the average minimum form sense found. The line of deduction may be represented as follows:—



"x" is faulty according to the above considerations and surely "y" is an example of circular thinking. It would seem that the prerequisite for "y" is the certain proof that Vitamin A deficiency does cause a defect in retinal dark adaptation or, permitting for the moment the validity of "x," a defect in the minimum form sense. Yet as the authors rightly indicate the literature on that aspect of the subject is inconclusive. As "y" is an important practical deduction it should wait until there is conclusive evidence that a deficiency in Vitamin 'A' to the degree likely to be found in Britain causes a defect in retinal dark adaptation.

These remarks, which so far are not constructive, are not meant to imply that vitamin 'A' cannot affect the process of dark adaptation in the retina. They are merely meant to show that the approach used by the authors fails to prove it. If it is suspected that vitamin 'A' can affect the mechanism of dark adaptation in the retina surely it would be well to use a test that so far as possible measures the peripheral retinal process and is independent of the central effect of the psyche. The minimum light sense unlike the minimum form sense is a simple sensation and as such is to a great extent independent of judgement and emotional state. It can be considered for practical purposes to be a measurement of the actual retinal process involved in dark adaptation. It is a very simple test, much more easily carried out than the minimum form test and it should always be the basis for the work discussed as well as for the investigation of the triple criteria which the authors so rightly dictate in their opening remarks.

It may be that working in the special circumstances of active service I have become too engaged with the pit-falls attending the use of the minimum form sense as a test of dark adaptation. Yet in the course of examining several hundreds of soldiers with the Koch adaptometer which supplies both minimum form and light sense figures one cannot but be impressed with the frequent discrepancy between these senses; with the great variation in minimum form sense among so-called normal individuals; with the

much more powerful influence of the mental state on the form sense than on the light sense; and with the important fact that the minimum light sense is practically never outside normal limits except in established organic disease.

I regret that I have found it necessary to be critical over such painstaking investigation but the problem will remain tangled and pre-judged if surmise and peradventure continue to

"drag at each remove a lengthening chain."

Yours faithfully,

I. C. MICHAELSON,
Major, R.A.M.C.

January 4, 1945.

OBITUARY

THOMAS HARRISON BUTLER

BY the death of Thomas Harrison Butler on January 29, British Ophthalmology has lost one of its outstanding personalities. The son of a clergyman, he was born in 1871. His early education was received at Dorchester Grammar School and St. Paul's School. Proceeding to Corpus Christi College, Oxford, he obtained first class honours in Natural Sciences. His clinical course was taken at St. Bartholomew's Hospital and from there he qualified B.M. in 1895.

After holding a number of resident hospital appointments, a Radcliffe Travelling Fellowship enabled him to widen his experience by study on the Continent for several years—during which time he worked at Paris, Berlin and Vienna and other centres. Later he practised for several years in South Africa and on returning to this country he obtained his doctorate of medicine in 1902. For 4 years he was Assistant Surgeon to the British Ophthalmic Hospital at Jerusalem, where he gained valuable experience in eye diseases, which laid the foundation of his future career.

On his return to England, he commenced practice as an Ophthalmologist at Leamington and Coventry, and became Honorary Ophthalmic Surgeon to the Coventry and Warwickshire Hospital and to the Warneford Hospital, Leamington. In 1913 he was appointed a member of the honorary staff of the Birmingham and Midland Eye Hospital. Retiring from this position in 1932, he returned to assist the depleted staff when his son—who was Assistant Surgeon to the Hospital—was called to the Forces at the outbreak of war.

He wrote much and was a frequent contributor to the Medical Journals. An authority on the slit-lamp, his book: "An Illustrated Guide to the Slit-lamp," was the first printed in English on this subject. It is interesting to note that practically all the illustrations in this book were reproduced from his own drawings—for he possessed considerable skill as an artist.

He was a familiar figure at most of the society meetings and during his long career he came to hold with distinction many high offices. At different times he was President of the Ophthalmological Society of the United Kingdom, of the Ophthalmic Section of the British Medical Association and of the Midland Ophthalmological Society. The last named society was especially indebted to him, for not only was he president for three years but was honorary secretary for nearly 30 years. For many years he was a member of the Council of the Oxford Ophthalmological Congress and contributed much to its success. He delivered the Doyne Memorial lecture and received the Doyne medal in 1924 and was Middlemore lecturer in 1915, 1922 and 1930.

As evidence of his outstanding merit and of the esteem in which he was held by his colleagues, he was elected an Honorary Fellow of the Royal College of Surgeons in 1941—a rare but well deserved honour.

A man of unbounded energy and enthusiasm, he succeeded in infusing others with these qualities. He was always ready to help and advise his House Surgeons and juniors, and many of us, both in this country and in the colonies, owe him a debt of gratitude. He derived the greatest satisfaction from his work, gave of his best to it and was always anxious to share his knowledge and experience with others. Patients were not merely cases to him but individuals in whom he took a deep interest, who could look to him for help and advice.

Even in his later years, he retained a youthful outlook and any new departure in treatment or new technique in operating claimed his attention and interest.

To interests outside his profession he brought the same whole-hearted enthusiasm. He was a well-known yachtsman and a keen member of the Royal Cruising Club. Last year he was President of the Little Ship Club. In the little leisure he had, he achieved a wide reputation as a designer of small cruising yachts and has recently written a book on the subject.

His genial and kindly personality endeared him to all with whom he came in contact. He will be greatly missed, not only in his own immediate circle, but wherever ophthalmologists meet, and those who knew him well will feel a sense of personal loss—the loss of a great colleague and friend. Our sincere sympathy is extended to his widow and family.

C. R.

Dr. F. A. Anderson writes:—

It is difficult to realise that Harrison Butler has left us and that we shall not again see that benign figure at our meetings, for no ophthalmological gathering seemed quite complete without him. He was an undoubted personality and he brought an air of bonhomie to an assembly which had a quality all its own. In this respect he

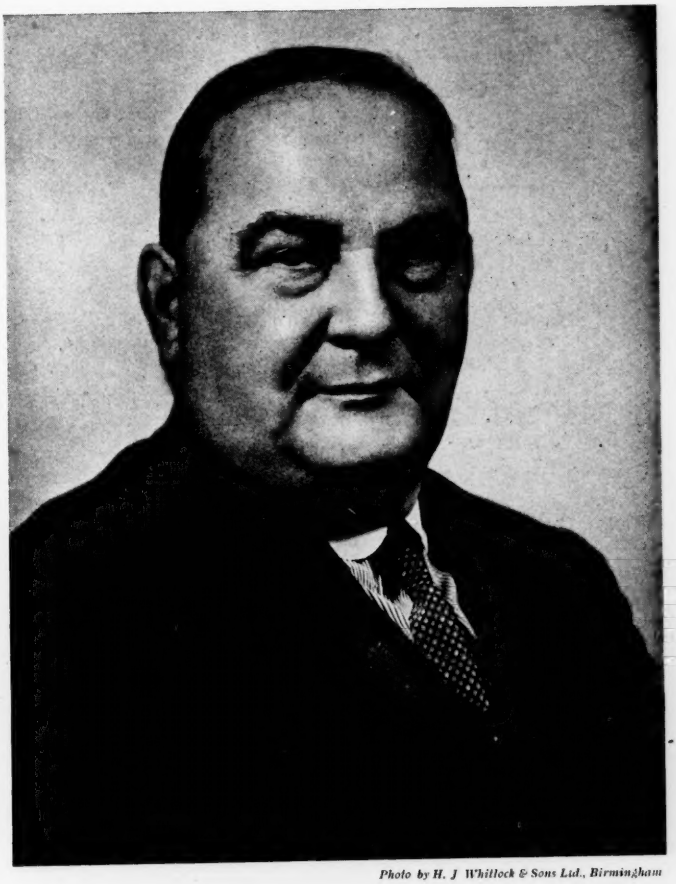
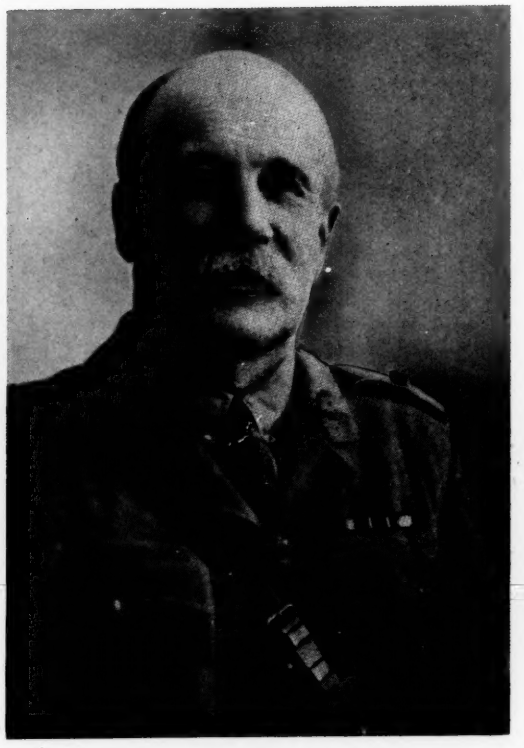


Photo by H. J Whitlock & Sons Ltd., Birmingham

THOMAS HARRISON BUTLER



JOHN LOCKHART GIBSON

changed very little in the last thirty years. His humour had a certain Churchillian quality and like that great man he was great enough and honest enough to be able to make a joke at his own expense or to confess to some minor fault in technique which frequently untied the tongues of more reticent members to the great advantage of the meeting. His contributions to debate always had the flavour of originality, coupled with much wisdom, learning, and common sense, while his wide experience and keen observation enabled him to shed light on any subject. Many of us owe a debt of gratitude to Butler for his "Illustrated Guide to the Slit-lamp" which was the first original book on the subject in English. It was characteristic of him that he always referred to his book as the "Child's Guide to Knowledge," thus refusing to accept a pedestal to which it might well have entitled him.

Butler was perhaps seen at his best at the Oxford Congress which he served with great devotion and enthusiasm from its inception. He read the Doyne Memorial Lecture in 1924. As a member of the Council since 1917 he seldom missed a Meeting and his contributions to the deliberations of that body were largely responsible for the success of the annual meetings, both on the academic and social side. At the Congress itself his many papers showed a genius in the selection and presentation of subjects which would stimulate lively discussion and evoke valuable comment even from many of the more diffident and less vocal members. On the social side his confiding friendliness and infectious good humour made him a centre of affection and amusement, which added so much to that happy family atmosphere which has always been such a delightful feature at Oxford.

Our sympathy goes out to his wife, to whose devotion and help he owed so much and to his family. May those great qualities which endeared him to so many of his colleagues be an abiding memory and consolation to them all.

JOHN LOCKHART GIBSON

THE death of Mr. Lockhart Gibson on September 30, 1944 was noted in our December issue. We are now able to give some details of his career, thanks to the courtesy of his son Dr. Walter Lockhart Gibson, who has sent us a copy of the notice in the *Medical Journal of Australia*. Our facts are taken from this source with acknowledgements to the editor.

John Lockhart Gibson, who had been our Brisbane correspondent since our start in 1917, was of Scottish extraction and born at Ipswich, Queensland in 1860. His education was at the Ipswich Grammar School and his medical training was from Edinburgh. He had a brilliant academic career in Edinburgh and deputised for Professor Rutherford in giving the lectures in physiology when the

latter was taken ill. He put in post-graduate classes in London, Berlin and Vienna before returning home. He was offered a post as physiologist in one of the London medical schools, but preferred to return to the land of his birth. He began in general practice in Brisbane and we gather that his position at this time was not too easy on account of his high scientific training which was not altogether appreciated by the more elderly of his colleagues. He was on the staff of the hospital for sick children but a breakdown in health put him out of service for a year and a half and he decided to give up general practice and confine himself to ophthalmology. Here he at once made his mark and his work with Dr. Jefferis Turner on ocular plumbism was of the greatest importance. In 1915 he was in charge of the ophthalmological department at Mudros and to the end of his life was active in the interests of repatriated soldiers. For many years also he was a member of the Australasian Medical Publishing Co.

He was the author of numerous papers on ophthalmology as well as some earlier ones in anatomy and physiology. It will be recalled that he wrote on ocular plumbism in children in this Journal in 1931. Mr. Lockhart Gibson died in harness while president of the Ophthalmological Society of Australia.

NOTES

Association for the Prevention of Blindness, Bengal 14th Annual Report

THE 14th Annual Report for the year ending March 31, 1944, covers much the same ground as that of previous reports. Work was somewhat curtailed by war conditions and by the famine crisis, but five travelling eye dispensaries have been at work throughout the year. This is the minimum requirement for so large a province. The report emphasises the importance of prevention in ophthalmology which is summed up under three headings, *viz.*—Improvement of ophthalmic services; Education of the public; Research. During the year Sir Clutha Mackenzie, of St. Dunstan's, who was appointed a special officer by the Government of India, submitted a comprehensive report on blindness and welfare of the blind in India to the Government. The latter, in the department of education, health and lands, appointed a committee to consider this report and to formulate ways and means as to how best to give practical shape to his recommendations. Lt.-Col. E. O.'G. Kirwan, C.I.E. represents the association on this Committee. The usual appendices conclude the report.

* * * *

Special Notice

WE are asked by the Ministry of Information to state that the fact that goods made of raw materials in short supply owing to war conditions are advertised in this journal should not be taken as an indication that they are necessarily available for export.